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YOUR SPECTRUM

What are we here for?



There are magazines and there are magazines — and when it comes to microcomputer publishing, there are even more magazines. But however wide the choice, always there seems to be an unquenchable public thirst for more.

The Sinclair Spectrum has been an astounding success story. Who, after all, could resist saying "Wowee!" to the idea of 16K plus colour for under the ton (even though many buyers promptly added the extra thirty pounds to triple the available memory)? And even if the machine is no longer 'new', still nothing seems able to staunch the flow of demand.

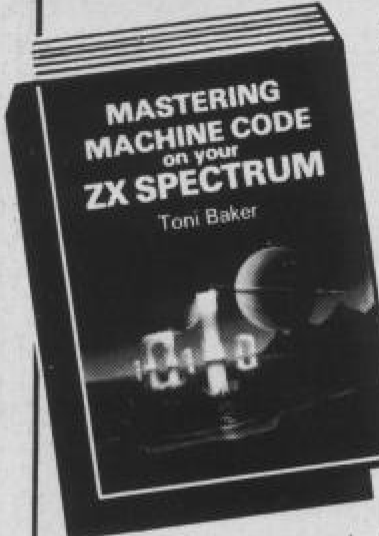
However, times they *are* a'changing and yesterday's newcomer aspires to be today's Spectrum literate. *Your Spectrum* evolved with them in mind. It's for those who are eager to step beyond basics. For those who enjoy testing and stretching their own knowledge and expertise. The magazine in comparison to others, may seem a bit of a 'Vogon', but that's because we're on a new interstellar highway — one which doesn't stretch logic to the point of boredom. And at times the content may seem a bit tricky to some of you — tough, that's what progress is all about! Don't give up, because we're in business to broaden your computing spectrum.

Your Spectrum will be many things to many people: a forum for ideas; an open door for those who 'do' to explain how they 'did' it; and a place where Spectrum owners are able to share their enthusiasm with others.

Your Spectrum is about YOUR Spectrum — keep in touch. Accept no substitute. Tell us what you think.

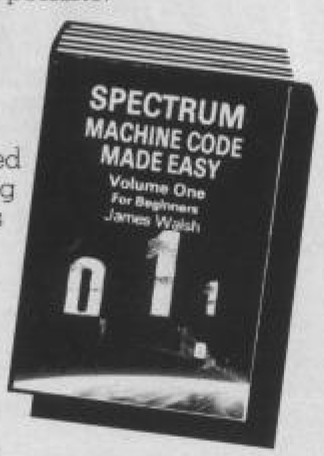
Bruce Sawford

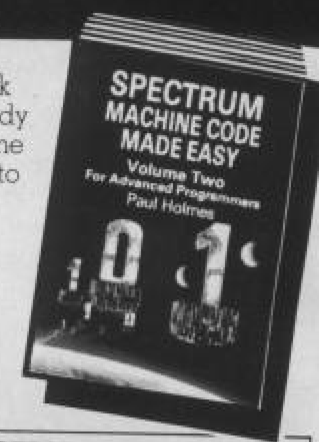
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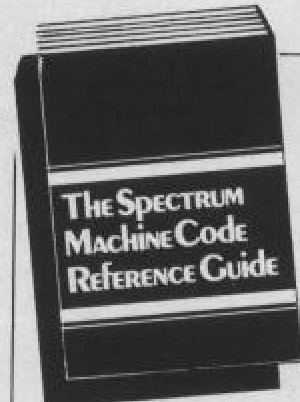


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Toni Baker £9.95
This 315-page book is designed to teach you the essential elements of programming in machine code. Written by Toni Baker, author of the highly successful 'Mastering Machine Code on the ZX81', this new book assumes absolutely no previous knowledge of machine code whatsoever, and yet promises to take you to a level of proficiency beyond your wildest dreams. Starting with simple addition and subtraction you'll be slowly guided through the entire subject of machine code. The book explores and utilises the incredible speed of machine code, giving you real time graphics games like BREAKOUT and leads you up to a full working DRAUGHTS program. Among other useful skills you'll acquire the ability to create music in real time (impossible in BASIC) and to plot in high-resolution graphics faster than you would have believed possible.

SPECTRUM MACHINE CODE MADE EASY
Volume One — James Walsh
Volume Two — Paul Holmes
These two books provide a graduated course in machine code programming on the ZX Spectrum. Book one starts off with the basic concepts of machine code, followed by an explanation of binary maths, hexadecimal and base conversion, leading as quickly and painlessly as possible onto the rules and types of addressing the Spectrum's powerful Z80 microprocessor. Book two is designed for those who already understand the rudiments of machine code programming, and now wish to increase their skills.
Each book is just £5.95







THE SPECTRUM MACHINE CODE REFERENCE GUIDE
Microdrive, Interface 1, and ROM Disassembly
Richard Ross-Langley £4.95
This 170-page reference work for Spectrum machine code programmers contains a full disassembly of the Spectrum ROM, with details of the Microdrive and Interface 1. Features of the disassembler include: Zilog mnemonics are used, eg LD A, (HL) instead of MOV A, M; relative jumps show the signed decimal offset and the result; hex values are default and are printed without suffix; decimal values are preceded by a plus or minus sign; and some restart instructions are followed by data bytes. The absolute addresses of all system variables and several important routines have been named, using where possible the standard names shown in the manual. The chapter headings in the Microdrive/Interface 1 section of the book include the RS232 Interface; Microdrive Channel data; Local Area Network; Network Algorithms; System Variables; and a summary of functions. **This book is a must reference work for serious Spectrum machine code programmers.**

Interface Publications, Dept. YS, 44-46 Earls Court Road, London W8 6EJ

Please send me the following books. I enclose £________

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FRONTLINES

A SMOOTHER PASSAGE

Don't waste your time complaining "If only I'd bought a Grunge 96 instead of this rotten Spectrum which won't load programs", because owners of the Grunge 96 are having the same problem, and can do nothing about it.

It is true that Spectrum programs aren't always easy to save on tape. Sometimes they save all right, but won't load, which isn't much help. And sometimes, commercially supplied programs won't load either.



Quiet now! It's the ZX Tapeloader.

In that case, we have the recommendation of Elinca Products that you spend £15 on something they invented earlier this year for Sinclair ZX81 users — a ZX Tapeloader. The Spectrum version costs roughly the same. It fits between Spectrum and tape cassette recorder, replacing the normal grey cables, and filters noise out of the signals in both directions.

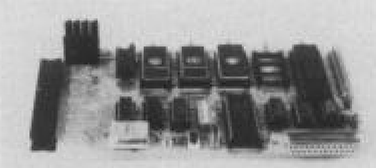
It isn't guaranteed to work, but if the problem is incompatibility between computer and recorder, then it should help. And it has the extra benefit of switching cables — because one of the most common causes of failure to load and save is feedback from EAR socket to microphone.

It's available mail order from Elinca at Lyon Works, Capel Street, Sheffield S6 2NL, and a cheque or postal order for £14.99 covers postage, too.

ON THE CARDS

Goodness knows what mad thing you want to do with a Spectrum operating a relay. Surely, you wouldn't be dreaming of using it to turn the lights on? Or to dial phone numbers? But that's probably illicit! Well, on your own head be it but, first, you'll need a parallel input/output card.

And there is one made by Cambridge Microelectronics, who will send you details if you write to them at 1 Milton Road, Cambridge CB4 1UY.



A BIT NIFTY

You don't expect Conran chrome for £18 (including VAT and delivery), so don't ask PH Scientific Products for more than a tidy Spectrum.

The company's black ABS plastic unit has places to hold the Spectrum, the transformer, the printer, and even the television, leaving just the wires to the tape player for the cat to play with. It also tilts the TV set back a bit.

Details on 07073 20241.



FORTH STAGE BOOSTER

Should you ever meet a professional computercrat who smiles encouragingly at your Spectrum programming and suggests that "it's time you got yourself a real computer", show him the David Husband Forth extension.

Forth is a language, but the extension could be called a modem driver, or a printer driver, or a turbocharger. And what David Husband's circuit will do, when he releases it around December, is to give Spectrum users the ability to run ten programs simultaneously. It could send messages down the phone lines, print on standard computer printers, and perform serious control operations.

But best of all, say those who know Husband's Forth, it runs ten times, or a hundred times, or even more, faster than the speed of the Spectrum — while costing a mere £59 plus VAT.

Husband has already been raved about for the Forth he produced — on a chip — for the ZX81. The language is at least as easy as Basic to understand, and many times more powerful to use. And Husband's Forth is unusually clever.

On the Spectrum he has found a way to use the same area of memory that Sinclair uses for the Basic — which means that he doesn't eat up Spectrum memory, as a Forth would if you had to load it from tape. But the Forth code can switch the computer back into being a Spectrum which in turn (properly programmed) can hand control back to Forth. So Basic programs can use the Forth board's Centronics port and RS232 serial port.

At press-time, David Husband was still mulling over final design features, such as "shall I include a RESET button?" or "maybe we should have the BREAK function operate only with two keys down", and so on. It seems certain though that he'll offer a terminal control program on the board, and also that he'll use some of the Spectrum's memory as a pseudo-disk (making Forth 'real' and fast, instead of a FIGment of the Forth Interest Group's enthusiasm.

If you want to know more about that little dig, or about Forth, but can't wait till Christmas, a ZX81 at £40 plus his Forth chip at £25 could make a great introduction. He'll even sell you a ready-converted ZX81.

Details from Densham Computers Ltd, 329 Ashley Road, Parkstone, Poole, Dorset BH14 0AP, or from Watford Electronics.

Oh, it gives you a real-time clock, too. And split-screens . . .

USEFUL IMPRESSIONS

It's obvious that Flet-Elec Computer Programs can think of vastly more uses for a pen with a switch in it, than most of us. What it offers, for around £50 at first, is an extension to the Spectrum which can detect the operation of up to eight switches. "These can be optical, magnetic, heat sensor or cold sensor, push-to-make or push-to-break, or any combination", the maker observes.

The first two offerings are: a pen, and a wheel.

It's at this point that it becomes clear that their imaginations are better equipped to understand people's problems than most. "The pen switch is a specially designed pen, and connects to the main device via a lead, which is of some three metres but can be extended to almost any length. It has a normal ink refill, and will operate as a pen."

It will also enable an estimating program to count the number of times you press the pen into paper "so for example, to carry out an estimate in building services, it's necessary to take off quantities of material. Therefore, lay out drawing, set computer with software running, then select item to be counted, and using the pen, tick each item on the drawing — and as the item is ticked, the quantity is added up. On conclusion go to the next item."

The company has thought of lots of other applications, too, but you get the idea. Contact them on 0934 852576.

PROJECT 1

Your Spectrum presents the first of a series of programming projects. They won't make you rich, famous or more attractive to the opposite sex — on the other hand, they will set you thinking.

What a pain it is, plotting pixel 'positions'. Even the simplest of shapes can prove quite tiresome to produce using Basic. So, to remedy this unfortunate situation, *Roger Pramm* has begun work listing a program that'll respond to any one of eight keys, drawing lines in the appropriate direction as it goes. It's based, sensibly, around eight points of the compass — north, south, east and west with their four subdivided subordinate locations.

Once you've keyed in the program and hit RUN you're ready to go. Using the T, Y, U, G, J, B, N and M keys, you can instruct the Spectrum to draw a straight line in the direction of your choice — that direction being determined by the key pressed.

Unfortunately, the program has a sizable bug that needs weeding out before it will give anything like a satisfactory performance. It nearly works but tends to behave a little strangely under certain conditions. For example, suppose you reach the edge of the screen at an angle of 45°. Instead of the line coming to a dead stop, it usually carries on, but in the opposite direction; in this case, 90° from the angle of incidence. However, other peculiarities sometimes occur, such as inconsistencies between the angle of incidence and that of the deflected line. Also, going off the edge of the screen can sometimes cause your faithful old box of chips to topple over and return to command mode, thus effectively removing this bugged-up piece of coding from memory.

The task, therefore, is to work out what's causing such strange goings-on. Why should the program, on some occasions, conform to the laws of physics (and maths) while on others behave in such an erratic fashion? We'll be reporting on your findings in a later issue and hopefully, too, from these we'll be able to include the code changes necessary to make everything work correctly.

Send all thoughts/corrections/conclusions to: *Project 1, Your Spectrum, 14 Rathbone Place, London W1 1DE.*

```
 100 DIM C$(12,1)
 110 DIM A(12)
 120 DIM B(12)
 900 GO TO 9000
1000 FOR N=1 TO 8
1100 IF INKEY$=C$(N) THEN  LET X=X+A(N): LET
Y=Y+B(N): GO TO 1500
1200 NEXT N
1300 IF INKEY$="Z" THEN  GO SUB 2000
1420 IF INKEY$="A" THEN  GO SUB 3000
1430 IF INKEY$="Q" THEN  GO TO 9999
1450 GO TO 1000
1500 IF X>253 THEN  LET X=X-1
1510 IF Y>174 THEN  LET Y=Y-1
1530 PLOT X,Y
1540 GO TO 1100
1550 REM END OF MAIN LOOP
2000 INPUT "X =";X
2200 INPUT "Y =";Y
2300 RETURN
3000 INPUT "INK =";I
3100 INK I
3200 RETURN
8000 INPUT "NAME ";N$
8100 SAVE "N$"SCREEN$
8200 RETURN
9000 FOR N=1 TO 8
9100 READ C$(N)
9200 READ A(N)
9300 READ B(N)
9400 NEXT N
9450 GO TO 1000
9500 DATA "Y",0,1,"N",0,-1,"J",1,0,"G",-1,0,"U",
1,1,"T",-1,1,"M",1,-1,"B",-1,-1
9900 INPUT "SAVE ? ";R$
9910 IF R$="Y" THEN  GO SUB 8000
9920 STOP
9999 GO TO 9900
```

JOIN THE CLUB

The ZX Machine Code Users' Club is alive and well. If you would like to find out more about the only users' club in the country which is dedicated exclusively to machine code, write for more information to: Toni Baker, The ZX Machine Code Users' Club, 37 Stratford Road, Wolverton, Milton Keynes, Bucks MK12 5LW. Remember to enclose a stamped addressed envelope.

SINCLAIRWATCH

BY GUTTERSNIPE

The past few months have been busy ones indeed for those within the mighty portals of Chateau Sinclair – we've seen the launch of several new products and some of the problems caused as a result.

ENTER THE ROM

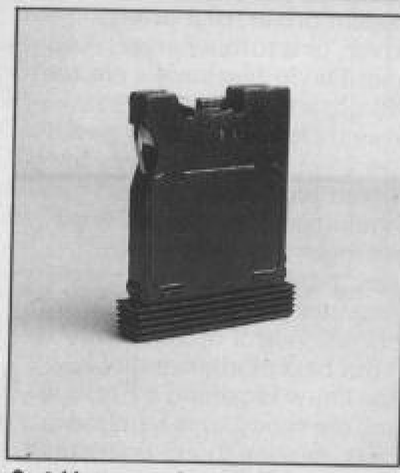
Hot on the heels of the flat screen TV, the Interface 2 was launched, allowing Spectrum owners to use ROM software and joysticks. Old Sinclair games and the more recent Ultimate ones make up the initial range of software but don't, at least for the time being, expect much in the business line. The problem is that the machine code in the cartridge cannot use any of the existing routines in either the Basic or the Microdrive ROM, so a programmer must re-invent the wheel every time he or she wants to print a character, read the keyboard, or save to tape or Microdrive. This latter function will be very difficult for any independent software house to duplicate because Sinclair Research is not going to allow any technical details of the Interface 1 to be published. The company is also intending to regularly change the ROM contents. It says it does not regard the ROM as sacrosanct and that only what's published can be relied upon to appear in subsequent releases. This will only succeed in making machine code routines much harder to write.

Some of the adverts for the new ROM Interface might give the impression that 48K cassette programs will work on 16K machines with the ROM adaptor. Of course this isn't the case, so don't expect *The Hobbit* or *Scrabble* to appear on ROM for the cheaper model.

The Interface 2 also accepts two joy-sticks, but uses a non-standard method of interfacing. This means that no software will work with it, other than the ROM games and Sinclair's own cassette games. Interface 2 should certainly be reliable — in fact the design is so simple, the wonder is that it took 16 months to produce, or even that the hardware wasn't included within the original Spectrum design.

WHICH CARTRIDGE

A state of confusion may well have arisen over the word 'cartridge', which can apply to either the Microdrive type (for the Interface 1) or the ROM type (Interface 2). Up until a month before its launch, the Microdrive variety was to be called a 'capsule', but for some curious reason this was changed at the last minute. Some Sinclair Research documents still refer to it by its previous and perhaps more sensible name. The trade, meanwhile, is now calling the ROM cartridge a wafer.



Cartridge . . . or 'capsule'?

ISSUE 3

Shortly after the Microdrive arrival, news leaked out of problems for some people with the Issue 3 Spectrum. The design of the ULA chip had been altered so that it would work with all colour televisions, but the EAR socket circuitry was changed, apparently making some software incompatible. Sinclair Research has publicly said it doesn't feel it should be held responsible for problems involving other people's software — perhaps with reason — but critics point out this is the third Spectrum ULA, and none have landed without causing ripples of some kind.

MICRODRIVE MANOEUVRES



A rare sight indeed — the ZX Spectrum complete with Interface 1 unit!

IAN McKINNELL

Then we had the final coming of the long awaited Interface 1 and Microdrive. As so often, to begin with only the magazines were lucky enough to get any — indeed, so short on supply were they that each publication was limited to only about ten days' playing around time before having to hand the gubbins along to its rivals. Not until about a month after the launch did those who ordered Spectrums very early on get their Microdrives. It was probably just as well that no-one else did as the first ones only worked on Issue 1 machines; these early models had EPROMs in them with '5 July' written on the top. The PCBs bore the hallmarks of early production — hand-soldered wire links and piggy-backed ICs; later models should work with all Spectrum variants.

The Microdrive, almost a year late in arriving, is proving to be both innovative and cheap, but once again cursed with unavailability. There also seem to be problems with reliability. Stories are beginning to emerge from users who've crashed the system for no apparent reason and who regularly wrap the tape in the cartridges around the machine's innards, rendering both completely inoperative. Indeed early customers have been given a hot line phone number to ring if they have any problems and a measure of the response that move has evoked is the fact that new phone lines are reported to have been added to deal with the rush of worried users.

The cartridges themselves are not exactly cheap at a fiver each and so far as I know there is no actual length of guarantee time so far decided. And Sinclair has no plans to market any software on cartridge — indeed as yet there is no way of mass producing such software anyway; the demo cartridges supplied with each Microdrive are created by a Spectrum hooked up to eight Microdrives. At the time of writing, other software houses (Melbourne House and Psion excepted) don't even have that — they are limited to two drives each, just like any other customer.

ON THE FLAT

The past few months have also seen the launch of the long-awaited flat screen miniature television. Once again innovative and cheap, its reliability factor has yet to be assessed — at the time of launch it was said that less than ten of the devices were actually in existence. Potential customers are able to write in to find how long they will have to wait (Timex industrial relations always permitting). If the delay is acceptable, then they are invited to send off their money.

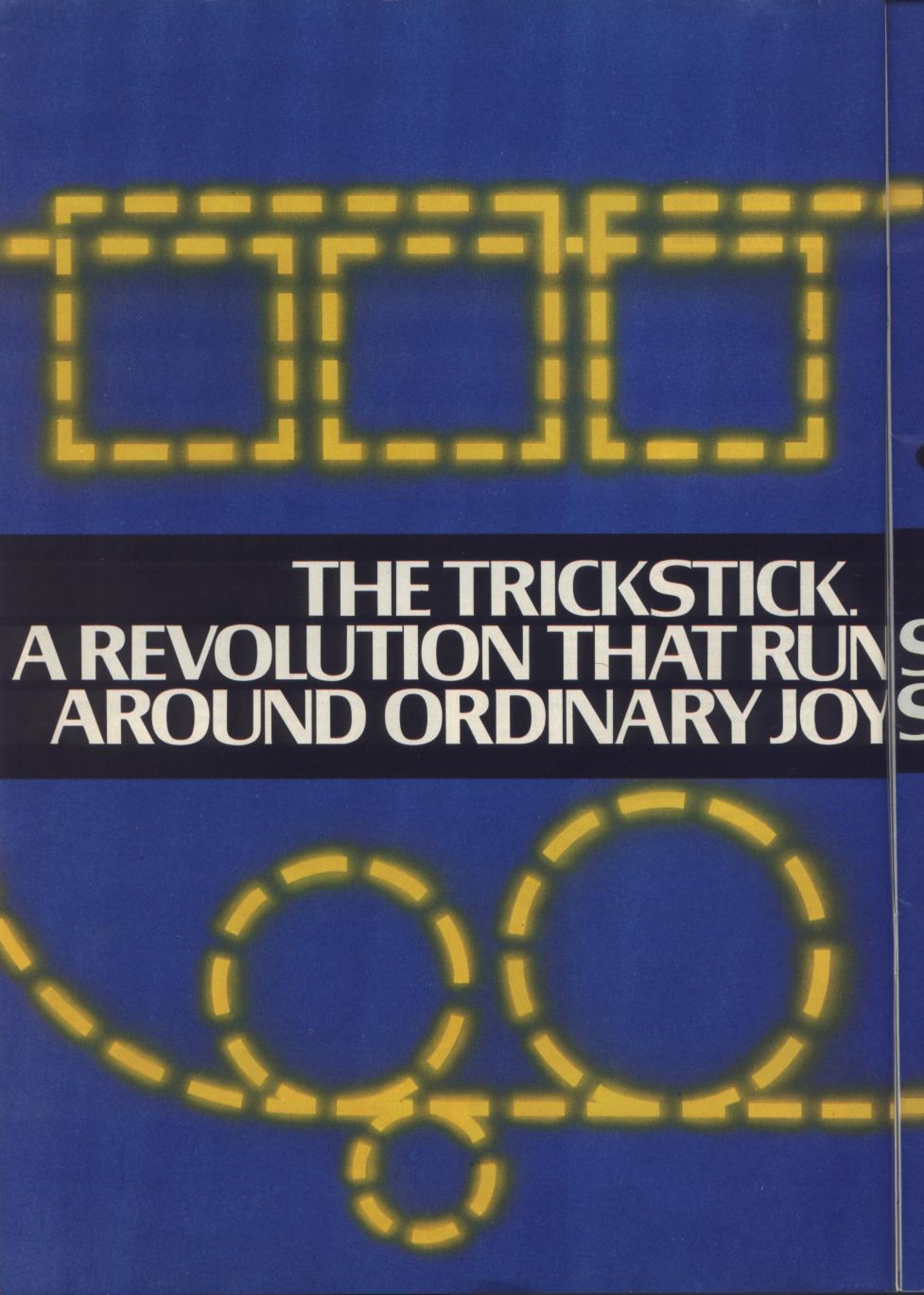




The ZX Microdrive in all its splendour

AND NEXT. . .

Faint rumours are beginning to emerge in respect of the next Sinclair computer, due for release early next year and thus dubbed by some the ZX84. It will have both 8-bit Z-80 and 16-bit 68000 processors, and contain two Spectrum-type Microdrives for data and program storage (hopefully, all problems sorted). It will not, apparently, have any in-built display monitor — and hence no flat screen, which will come as a surprise to quite a few. But for the very first time on a Sinclair machine it *will* have a real, pukka keyboard. Let's just hope that the Sinclair definition of 'real' is similar to that of IBM, and not Oric!


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SOFTWARE COMPATIBLE: Trickstick is compatible with any software which will work with the old-fashioned Kempston joystick.

PROGRAMMABLE: A low cost adaptor performs the technically simple job of making the Trickstick programmable, and compatible with ANY software.

NO MOVING PARTS: Small plastic-coated metal pads on the Trickstick detect how hard you are pressing by picking up electrical radiation from your fingers. This is then amplified and fed into the interface. So there are no moving parts at all;—not even the fire buttons. This arrangement was proved in competitive trials to give the greatest control and potential for spectacular skill.



And this makes Trickstick the only games system which does not wear out with heavy use!

ATTAKTICS: Trickstick gives new life to your existing software. Attaktics takes you and your Trickstick to new dimensions where skill and strategy are as important as the fast reactions of the very young. The game is very, very efficiently written in machine code and allows you to move in 64 different directions on the screen, giving perfectly smooth curves. Combine this with your new-found control of speed and rate of turn, and imagine aerial combat against your Spectrum or against other Trickstick owners!

USE THE COUPON OR THE PHONE: Trickstick and Attaktics are in stock and available now. Trickstick including interface is £28. Attaktics is £7.50 if ordered with a Trickstick and £10 on its own. The Programmable Adaptor is £10 for Trickstick owners and £15 for others. The Training Tape is Free with each Trickstick. Or call us for the name of your local stockist.

Please send me:–
[ ] Trickstick(s) with training cassette at £28 each £____ [ ] Attaktics at £7.50 (with each Trickstick) or £10 (on its own) £____ [ ] Programmable adaptor(s) at £10 (for Trickstick owners) or £15 (for others) £____ Postage 65p. I enclose Cheque/PO. for £____ made payable to East London Robotics Ltd.

My Access / Visa is [ ]

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Please send to: East London Robotics Ltd., Gate 11, Royal Albert Dock, London E16. 24 Hour information service: 01-471 3308. 24 Hour Access/Visa ordering: 01-474 4715. Special enquiries: 01-474 4430 (Telex: 8813271). Same day despatch to phoned Access or Visa orders.

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IQ TO U2



The so-called measurement of intelligence has always been a bit suspect, so it was with a degree of scepticism that we prised open the Cattell IQ test — one of a fistful of new programs put out by Sinclair Research itself at the PCW show in October. The package comes complete with a cassette carrying the test and an eight-page booklet explaining what to do, all at a brain-numbing £12.95. "This is the first time that a fully standardised and widely accepted IQ test has been available to the general public", says the introductory blurb.

It continues with a number of disclaimers which seem to infer that unless you are of above average intelligence in the first place, the results will be questionable. (Maybe you have to take another test before you take this one to see if you are up to its standard of test taking?) But for those brainy enough, advancement is near. "Your ZX Spectrum will tell you if you reach a level at which it would be worthwhile your applying to Mensa."

At this stage, scepticism became a teeny bit tinged with cynicism. For those few people in the world who don't know, the president of Mensa happens to be one Sir Clive Sinclair. Could the product be a new means of recruiting for the society of eggheads? Perhaps too we can look forward to other such products which test, say, manual dexterity for potential brain surgeons. But to be fair the booklet does point out that you should not take the results too seriously and adds: "This test will not prove conclusively that you are a genius — and those who do not do well at the test may well have other sterling qualities." Hmmm.

Your correspondent was not able to test out the quality of his own brain, but for more mundane reasons. A few days after receiving the cassette from Sinclair Research, a letter arrived telling us that there was a bug (in the program, that is) and that a replacement would soon be winging its way over. We are waiting — patiently. Watch this space.

BATTLE OF THE TAPES

Noticed anything different at the local newsagent lately? No, not the cleaned-up covers on the adult 'nasties' — the mini-revolution we're looking at here is the fairly recent birth of the machine-dependent computer software magazine. Two publications are vying for position in the prestigious 'computer publications' market. Both are priced at £2.99 and designed to run on the 16/48K Spectrum models.

First on the market was *Spectrum Computing*, edited by Iolo Davidson and one of the newer titles to emerge from the Argus Specialist Publications stable. But coinciding with the third issue came a rival in the shape of a package called *16/48* from Magnetic Magazines and edited anonymously.

With the simple instruction to LOAD "", both 'magazines' load a portion of their contents and when you've had enough of that bit, you simply press whatever keys are necessary, turn the tape back to play — and the next section of code then begins loading.

Spectrum Computing, being three issues young, has the advantage over *16/48* in that its audience (readers?) are already used to the format and are beginning to respond to the editor. This is made obvious by the wittily written and informative editorial and the inclusion of three letters which constitute the equivalent of a 'letters page'.

16/48, by comparison, has rather overdone the 'technology' bit with phrases like "Home computing has come of age" and the ambigious "Machine readability is all". The last statement is especially confusing when you notice that the text comprises a new graphics set made up of robotic-type characters — not the most legible for sifting through pages of on-screen text.

Both cassettes contain a couple of games programs, which while not arcade standard will certainly provide a degree of enjoyment. More interesting, though, are the routines. These are either accessed by breaking into the tape and LISTing or are included as features of the contents. Whichever way presented, they should be useful to the average programmer.

Reviews have been included on both tapes, software in the case of *Spectrum Computing* and hardware in *16/48*. Iolo has employed a nice technique to format his reviews. Each critique lasts for three pages (preventing too much eyestrain) and at any time you can press a key to see a 'frozen' image of the game in question.

16/48, on the other hand, has plumped for reviews of the dK'troniks light pen and RD Laboratories' digital tracer. These are simply text, followed by a high resolution illustration showing what the devices are capable of.

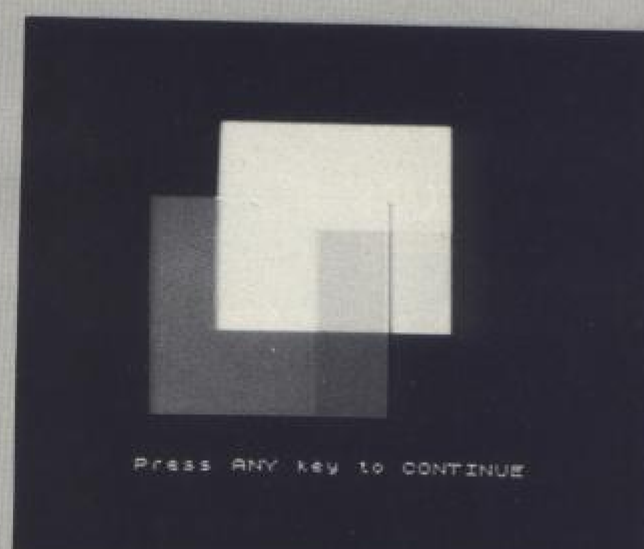
Both cassettes are obviously heavily influenced by the traditional magazine format, and as such have managed the transition to magnetic tape with surprising ease. Contents pages, 'next month' pages and mini-adverts are to be found, as well a rather interesting competition in the case of *16/48*. Contestants are asked to write "the most amazing animation ever seen in a magazine". Sounds easy enough! What, one might ask, will the winners receive for this major programming feat — answer, a digital tracer or light pen (better quickly check the review on side one).

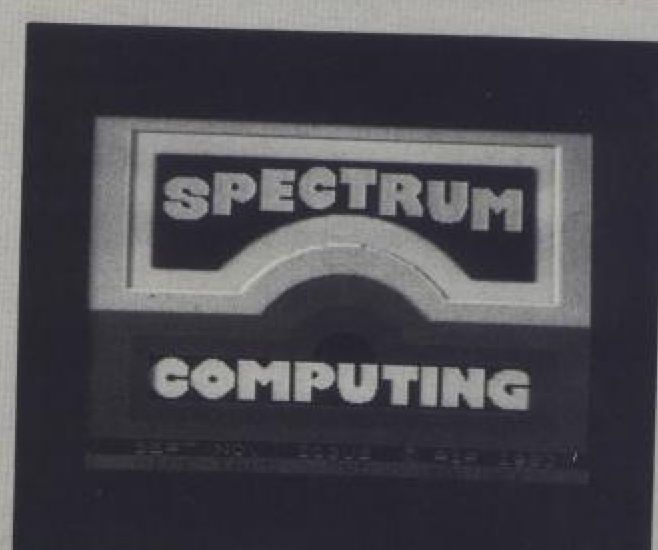
However exciting the editors would have us believe their products are, with so much professional Spectrum software now starting to achieve such high standards, any tape magazine that falls far short will do so at its own peril. And reading between the lines of the editorial in *Spectrum Computing*, it would seem as if many of the readers *are* baffled as to how to access the many and wondrous routines available.

And talking of problems, although our copy of *Spectrum Computing* loaded, the second side of *16/48* did not. Should you have the same problem, you might try loading the first program on side one, typing NEW to clear all but the UDGs above RAMTOP, and then trying side two again. Overall, although these packages seemed relatively easy to load, the fact is that computer cassettes do not have the same kind of reliable reputation granted to audio cassettes.

This is a new field of publishing, and a brave attempt to cash in on the information technology era. But the question is whether the idea of a magazine which demands you sit in front of the TV (especially with the advent of possible program broadcasting via cable) is one which will catch on.

However the publishers may describe their respective packages, it's obvious that products such as these are not really magazines in the generally accepted sense. One wonders why they slavishly set out to emulate their paper peers, when it seems more sense to create some new approach — one that better suits the electronic resources available. Answers on a postcard please . . . *RM*





JUST AROUND THE CORNER, A NEW R

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BLACK CRYSTAL

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Black Crystal is an excellent graphics adventure and a well thought out package. *Sinclair User, April '83*
Black Crystal has impressed me by its sheer quantity and generally high quality of presentation. I am afraid I have become an addict. *Home Computing Weekly, April '83*
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The ideal software package for all 16K ZX81 owners. Six major programmes on two cassettes for only **£6.50**
Alien Intruder/Hieroglyphics — Both programs make good use of graphics and words to make a very entertaining package. *Sinclair User Aug 82*
Alien/Hieroglyphics/Wumpus/Movie — A varied mix from Carnell, all featuring imaginative responses and graphics and all of them good games for all ages (Hieroglyphics is particularly good for children). *Popular Computing Weekly Aug 82*

THE DEVIL RIDES IN

I uttered the last incantations as the clock struck thirteen. All fell silent except for a faint rustling in the corner. From out of the shadows they came, all Hell's fury against me but I was not defenseless until the Angel of Death, astride a winged horse, joined the battle. Avoiding his bolts of hell fire, I took careful aim. My chances were slim, but if my luck held. . .

(Fast moving, machine code, all action, Arcade game)

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"The Wrath of Magra" comes as three, 48K programmes on cassette, boxed with instruction manual and book detailing the history of the Third Continent and the many spells you will be using throughout the game.

NOTE: "The Wrath of Magra" is a complete adventure. You need not buy "Volcanic Dungeon" or "Black Crystal" to play it.

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REVIEW COPY

Those who've been hanging around for over a year for a glimpse of the much-coveted ZX Microdrive and Interface 1 units, will be happy to know that they won't have to wait so long for the inevitable selection of 'how to' books to grace the bookshelves. Already two texts are available on Sinclair Research's new offspring, both of which attempt to fill the gaping holes left by the 'official' Microdrive/Interface 1 manual.

The first is called *The Spectrum Micro Drive Book*, written by Dr Ian Logan (of long-standing Spectrum fame) and priced at £5.95. Having assisted in the writing of the 'shadow' ROM software for the Interface 1 device, Dr Logan is certainly well-placed to write on the subject. And if it's technical questions you have, Dr Logan is the one who seems to have all the answers.

At first glance, the book looks more like an engineer's manual than a book on programming. The author has detailed the extended Spectrum system, the extended Basic, the Microdrive, the Local Area Network and the RS232 link, to the point where you could almost imagine seizing the soldering iron and building one yourself. Even though a short paragraph warns the reader that the author has been unable to break Sinclair Research's confidence on certain facts about the Microdrive, there's enough information on the unit to keep the most inquisitive happy. And no doubt someone a little less scrupulous will tear the system apart in the future.

The final chapter of the book deals with machine code, and as such rightly demands a large chunk of the text. After a detailed explanation of the various 'hook' codes (which with their association with the 'shadow' ROM are, as expected, covered very well by Dr Logan), there is a section showing how Basic statements can be formed, complete with four new ones especially created for us.

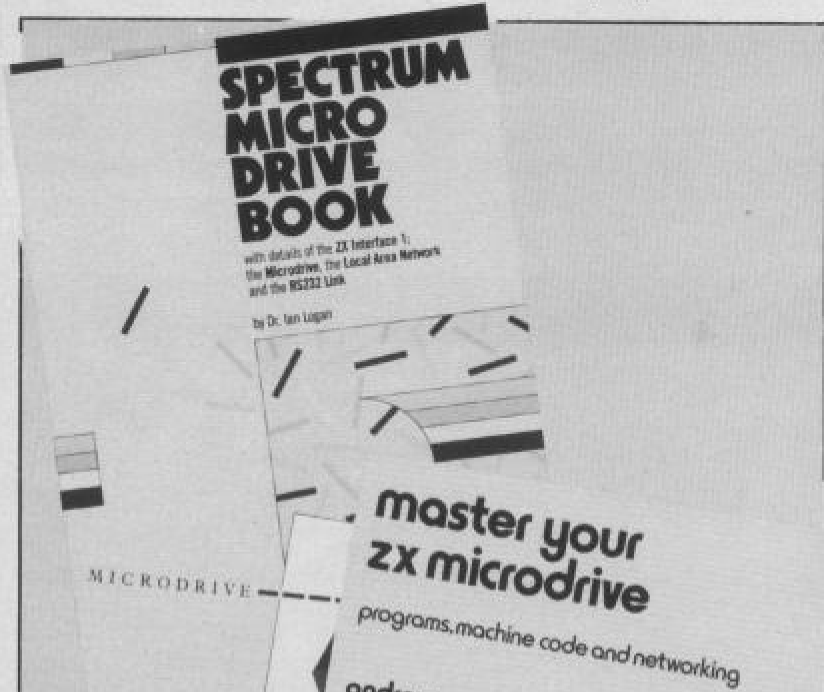
The second book, *Mastering Your ZX Microdrive*, written by Andrew Pennell and priced at £6.95, takes an alternative kind of approach. Here the author illustrates each command and programming technique associated with the Microdrive/Interface 1 units with a small program so that you can instantly test the power of your expanded system. The book even contains a database program, although I'm not convinced that its inclusion has been that necessary to the overall form of the text.

All the areas of interest are covered, illustrated by some nice programming tricks which might well save the user some agonising hours steaming away at the keyboard. For instance, the author has included a program to change the syntax of the cumbersome LOAD/SAVE/MERGE/VERIFY/CAT/RUN commands, and another which simulates the ON ERROR GOTO command found on many other computers which rival the Spectrum in this elevated form.

Although not having had access to quite the same technical insight afforded Dr Ian Logan, Andrew Pennell has come up with a book that offers thoughtful inclusions for the Microdrive/Interface 1 user. But I'm not sure of the relevance of the cover picture which sets the Microdrive high in the sky, godlike above a sparse desert — I didn't find the writing to be that dry!

Even though both books are pitching themselves at the same market, neither detracts from the other. Dr Logan's effort holds up as the manual which maybe Sinclair Research itself should have taken the trouble to bring out, whilst Andrew Pennell's offering provides enough useful text for you to want to start tapping away at your keyboard. The Microdrive/Interface 1 units are obviously going to stimulate many other authors to put pen to paper, drawn by the complexity and scope of the devices themselves, and the potential size of the market for books that deal with them.

Both the present books are well worth the read, and full marks to the publishing companies involved, Melbourne House and Sunshine Books, for meeting the challenge so quickly — it just seems a shame Sinclair Research couldn't do its bit by making the devices available to the computing public with quite the same enthusiasm. *RM*



Spectrum Micro Drive Book, by Dr Ian Logan and published by Melbourne House
Mastering Your ZX Microdrive, by Andrew Pennell and published by Sunshine Books

GREATER SCOPE

For all those who want to write graphics or arcade type games, there's a new computer graphics language from the Interactive Software People which allows you to do just that, and without any knowledge of machine code.

Known as *Scope*, the language resides in high memory and is run by using the USR command. It's a recursive compiler that takes the 31 user friendly command words and re-writes them in machine code; producing fast and efficient programs, quickly and easily. Most command words have two operands, but there can be as many as four — or none in a limited number of cases. A highly structured language, *Scope* is similar to FORTH in that a routine can be defined, then a further routine that combines the first, and so on.

In the next issue of *Your Spectrum* we will be running a competition for the best use of this program. And for anyone who doesn't yet own a copy, the word is that somewhere amongst these pages is a coupon giving £2 off your purchase (hint, hint).

EPROMS VARIOUS

Turn any Spectrum on, and you know what it will do: show you several coloured stripes, then go black, then give a Sinclair copyright notice. Experimenters like to plug their own chips into the system with their own programs on; but always there is the irritating need to get over the keyboard, and type at least one instruction before the machine will start running the code on the new chips.

An Auto-Start circuit for £10 is supplied by Eprom Services, which changes all that. It gives an automatic jump, after the Spectrum initialises, to address FD00 (hex) — which you can cover with your EPROM program.

Eprom Services also (naturally) sells various EPROM boards so that you can load your code into permanent memory, and full details of these are available on a typed catalogue from 3 Wedgewood Drive, Leeds LS8 1EF. Or phone 0532 667183.

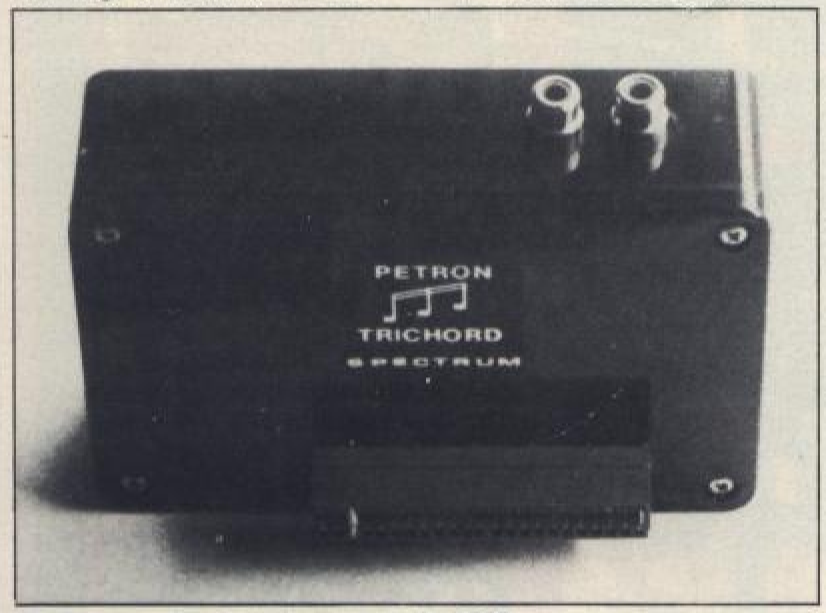
SPECTRUM IN HARMONY

BEEP, goes Spectrum Basic. By contrast, the Trichord has a full range of sounds, and can play three notes simultaneously.

With the Trichord, which was originally presented as a project in the experimenters' magazine Electronics Today International (ETI), there is a piece of software which helps the user who is not a trained musician to operate it.

The device with internal amplifier and speaker costs £28.95, while a bigger version, able to amplify the Spectrum BEEP costs an extra £1.00. There is the option of one without amplifier or speaker, at £26.95.

Details are available from Petron Electronics, Courtlands Road, Newton Abbot, Devon TQ12 2JA, phone 0626 62836. Don't just ask for a Trichord, because they need to know which Sinclair computer you have. And there is a demo cassette for an extra £1.25 inclusive.



The Trichord unit – Petron's answer to the BEEP.

NEXT TIME AROUND

The next issue of *Your Spectrum* will be on the streets in February 1984.

We'll be taking a comprehensive look at which printer interfaces to use alongside your computer — so, if you want to upgrade your printer output check it out here first. And the inimitable Toni Baker will be back with her machine code machinations and another little utility to get you nearer turning out that perfect piece of arcade software you always had it in mind to write.

There'll also be a study of the complexities of creating 3D graphics on the Spectrum and an article investigating the use of the Spectrum in a music recording studio.

DEBUGIT

"Simple pleasures . . . are the last refuge of the complex" — Wilde

You may be 'complex' but whoever wrote this little Spectrumised gem is clearly a mortal of a lesser plain. Actually it was put together, not by Guy Kewney, but by the office glitch, Dick Head, in a rare moment of partial lucidity — usually he finds it difficult just opening the post. Still, just a 'touch' of debugging here and there should do the trick, while at the same time providing some rich moments of simple pleasure to all you nouveau megageniuses who we are proud to call readers.

Help our Dick Head with his hopeless load of programming cobblers (actually, we reckon it contains ten appalling errors) and we in turn promise to smack him across the ear with the full weight of correct entries.

In addition, those extremely kind people at Spectrum (the dealer chain, that is), have agreed to cough up ten prizes each worth £25 — all readies to be spent at one of their vast number of affiliated computer shops. The first TEN correct entries out of the wastepaper basket will be declared the winners (as judged by anyone but DH) and for this great occasion, we could think of no more appropriate date than Friday, January 13 1984.

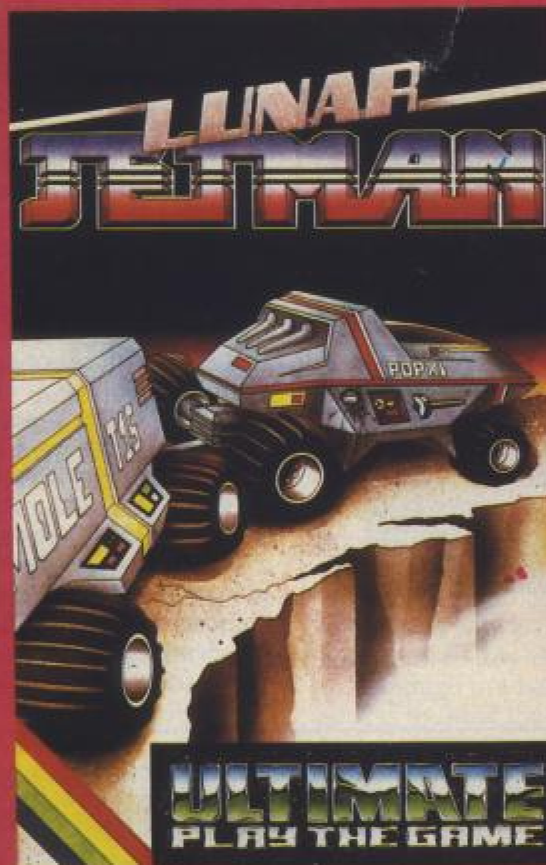
```
 10 BORDER 0: PAPER 0
 20 PRINT AT 1,1;"'Your Spectrum' program puzzle"
 30 PRINT
 40 PRINT
 50 PRINT
 60 BORDER 2: PAUSE 3
 70 INPUT s$
 80 PRINT "Think of a whole number between 0 and 2"
 90 INPUT r
100 IF r<>10 THEN  GO SUB 350
110 PRINT "Subtract your height (in inches)"
120 INPUT h
130 PRINT "Add your date of birth (ddmmyy)"
140 INPUT dob
150 PRINT "Add your bust/chest size (in centimetres)"
160 INPUT bc
170 IF bc<=90 THEN  GO SUB 520
180 PRINT "Subtract your bank account number"
190 INPUT bac
200 PRINT "Add your inside leg measurement (in millimetres)"
210 INPUT il
220 PRINT "Subtract the number you first thought of"
230 INPUT r
240 IF r<>10 THEN  GO SUB 350
250 CLS
260 PRINT AT 0,10; FLASH 1;"     WAIT A MINUTE, I'M NOW       EVALUATING ALL RE
LEVANT DATA  "
270 FOR W=1 TO 50
280 BORDER 4: PAUSE 3
290 PRINT "What's your sex? (m or f)"
300 BORDER 6: PAUSE 3
310 NEXT W
320 CLS
330 GO SUB 430
340 STOP
350 PRINT "NAUGHTY - '1' has been assumed"
360 PAUSE 75
370 RETURN
380 IF s$="m" THEN  GO TO 400
390 RETURN
400 PRINT "Really? What's your phone number?": INPUT ph
410 PRINT  FLASH 1;"Thank you. What are you doing tonight?": PAUSE 200: CLS
420 RETURN
430 LET n=INT (RND*10)
440 IF n>3 THEN  LET n=n-1
450 IF n=1 THEN  GO TO 480
460 IF n=2 THEN  GO TO 500
470 IF n=3 THEN  GO TO 520
480 PRINT "You are short, fat and ugly, and weigh 32 stones"
490 GO TO 260
500 PRINT "You are stupid and spotty, with severe B.O."
510 RETURN
520 PRINT "You are sylph-like and wonderful, and will soon be rich"
530 RETURN
```

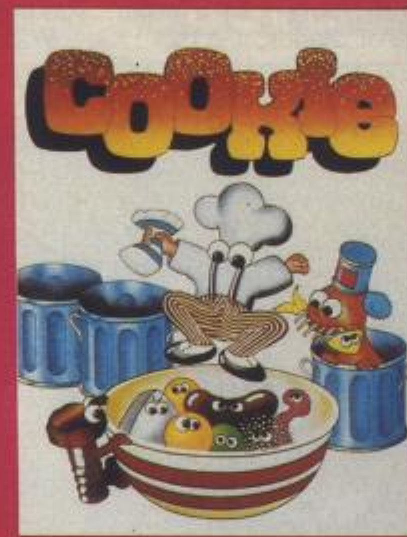
Please send your entries (on paper please) to:
Debugit Competition, Your Spectrum,
14 Rathbone Place, London W1P 1DE.

LUNAR JETMAN – 48K ZX Spectrum

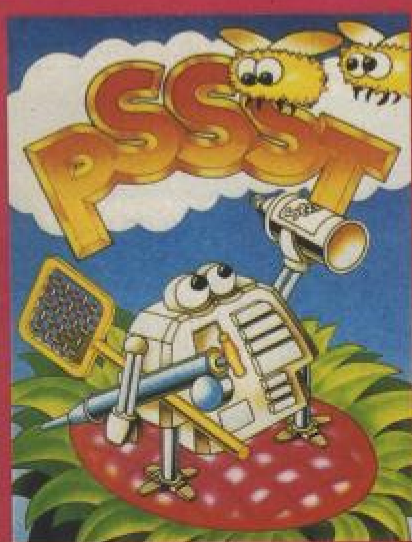
COOKIE – 16/48K ZX Spectrum

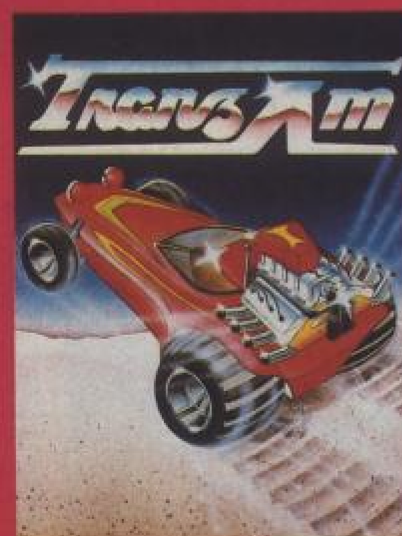
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LUNAR JETMAN – Arcade standard, 100% machine code, incredible sound effects, amazing smooth high resolution graphics, the totally new addictive concept and all those extra features you expect from the **ULTIMATE** games people.
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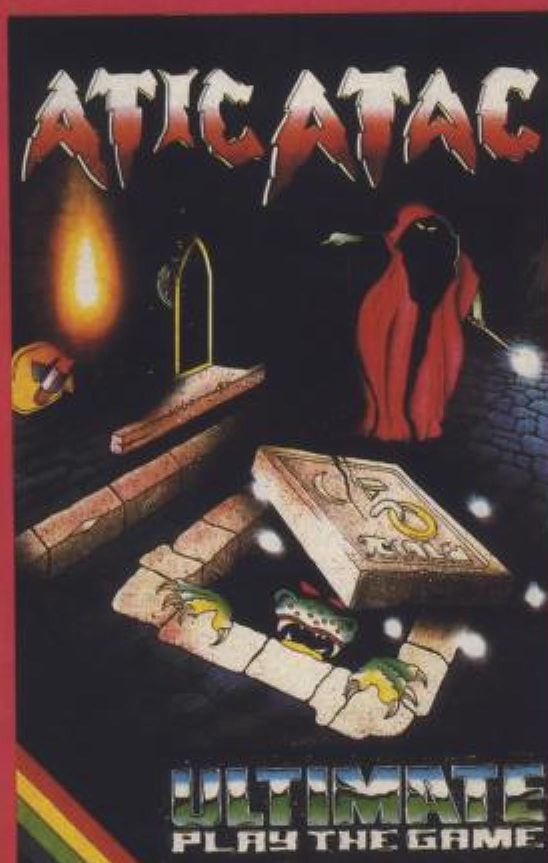




PSSST – 19/48K ZX Spectrum







TRANZ AM – 16/48K ZX Spectrum



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Once upon a time machine code gave rise to infinite loops. If such a loop was encountered then there was absolutely nothing you could do about it except pull the plug out and start again. Now, however, those sorry days are gone as, exclusively for readers of this magazine, **Toni Baker** *presents one of the most important Spectrum discoveries ever made. Learn from her the secrets of Spectrum RESET.*

MACHINE CODE BREAKOUT!

Consider the machine code program:

```
18FE   LOOP   JR LOOP
```

Not a very sensible program is it? Still, it makes a good demonstration. You probably won't need to actually try out the above program to prove that it causes a crash. The screen will freeze and the keyboard won't work. Infinite loops in Basic are usually easier to handle. For instance, the program:

```
10 GO TO 10
```

is also an infinite loop, but *now* note that if you press BREAK (ie. CAPS SHIFT together with SPACE) you are no longer stuck there. It is, however, possible to create loops which are quite difficult to break out of, for instance the program:

```
10 INPUT LINE A$: GO TO 10
```

In this example the only way out is to keep one finger on the CAPS SHIFT key and then press ENTER followed by SPACE in very, very quick succession. Try it if you like, but be warned — it's extremely tricky.

Now, however, those days are in the past, for there's been an important breakthrough. This is a *software controlled* system which adds a RESET function to the ZX Spectrum. The system is activated by the single instruction RANDOMIZE USR 33001, and will remain active until you *de*activate it by typing RANDOMIZE USR 32994. When the system is active, both Basic and machine code will work as normal; however, you will notice that a new function has been added to the Spectrum vocabulary. The function is called RESET and is operated by pressing CAPS SHIFT simultaneous with ENTER. The RESET function will immediately break out from *any* operation being carried out by the Spectrum and will return the computer to command mode, waiting for a new Basic keyword command.

Note, by the way, the useful feature that if you press RESET whilst typing in a command line in Basic then the

Machine code		Assembler	Comments
		ORG 80E2	
3E3F	DEACTIVATE	LD A,3F	
ED47		LD I,A	I: = 3F (Normal Spectrum value).
ED56		IM 1	Spectrum now in normal mode.
C9		RET	Deactivation complete.
3E80	ACTIVATE	LD A,80	
ED47		LD I,A	I:= 80.
ED5E		IM 2	Interrupts now vectored through the label I__ADDR).
C9		RET	
524553	RES__MESSAGE		Message to be printed on completion of task. Note that the code for '!' has 80h added
45542065			
78656375			
746564A1		DEFM RESET executed!	
0181	I__ADDR	DEFW TEST__RESET	Direct interrupt control to address labelled TEST__RESET.
F5	TEST__RESET	PUSH AF	Stack A and the flags.
3EFE		LD A,FE	
DBFE		IN A,(FE)	Scan segment zero of the keyboard.
1F		RRA	Test for CAPS SHIFT key.
3807		JR C,NO__RESET	Jump unless CAPS SHIFT is
3EBF		LD A,BF	
DBFE		IN A,(FE)	Scan segment six of the keyboard.
1F		RRA	Test for ENTER key.
3004		JR NC,RESET	Jump if ENTER is also depressed.
F1	NO__RESET	POP AF	Restore A and the flags.
FF		RST 38	Update the system variables KSTATE, LAST__K and FRAMES
ED4D		RETI	Return from interrupt routine.
2AB25C	RESET	LD HL,(RAMTOP)	
2B		DEC HL	
F9		LD SP,HL	Empty the machine stack
2B		DEC HL	
2B		DEC HL	
223D5C		LD (ERR__SP),HL	Reset the system variable ERR__SP.
AF		XOR A	
32715C		LD (FLAGX),A	Cancel INPUT mode if needed.
CD0116		CALL CHAN__OPEN	Use channel zero
CD6E0D		CALL CLS__LOWER	Empty lower part of screen.
213B5C		LD HL,FLAGS	
CB9E		RES 3,(HL)	Specify 'K' cursor required.
23		INC HL	HL now points to TVFLAG
CBEE		SET 5,(HL)	Signal that the lower part of screen will require clearing.
AF		XOR A	
11EF80		LD DE,RES__MESSAGE-1	
CD0A0C		CALL PO__MSG	Print "RESET executed!"
FB		EI	Re-enable the interrupts.
C3A912		JP MAIN__1	Jump into command routine.

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entire line will be deleted. This serves much the same purpose as pressing EDIT when trying to input something.

The machine code begins at address 80E2. It is *not* relocatable (although you may like to try rewriting it so that it is designed to sit at some other address). It's activated by calling it from the label ACTIVATE, and deactivated by calling it from the label DEACTIVATE.

If you load in the code in the table to address 80E2 (equal to decimal 32994) using any machine code loader program, and then run the machine code from address 33001 (80E9 in hex — this is the address of the label ACTIVATE) you will find that the power of your Spectrum has been vastly improved, for you now have a RESET button! RESET, remember, is CAPS SHIFT and ENTER.

Type in and run the following machine code program, and then use RESET to break out, just to convice yourself that it works:

```
18FE  LOOP  JR LOOP
```

Now try the Basic infinite loop:

```
10 INPUT LINE A$: GO TO 10
```

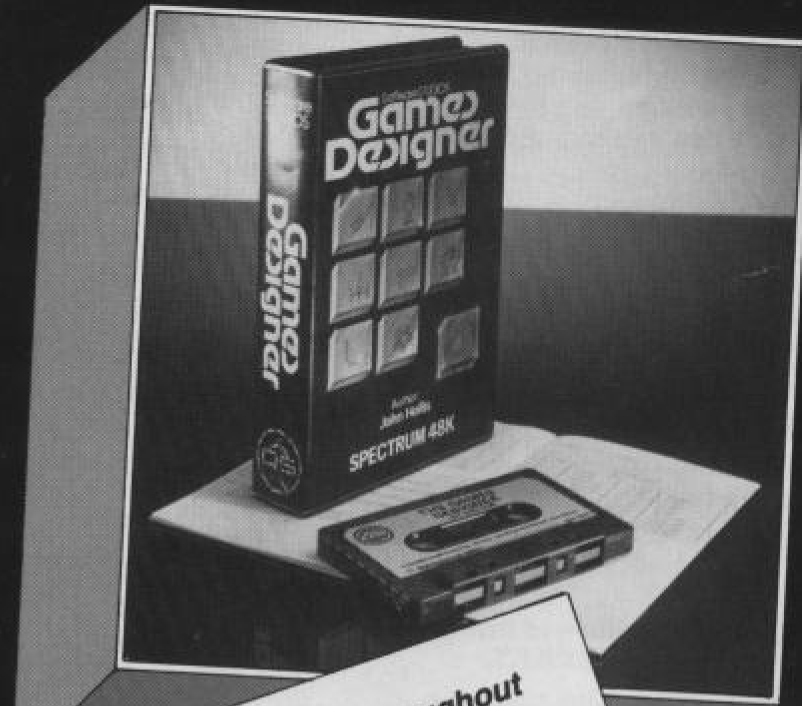
and break out of *that* using RESET. Type in any Basic program, and then press ENTER on its own to get an automatic listing. Now — quickly — before the listing fills the screen, press RESET and interrupt it halfway through. Even that works!

Some things to know about RESET

- To activate the RESET facility type RANDOMIZE USR 33001.
- To deactivate the RESET facility type RANDOMIZE USR 32994. You are warned not to rely on using RESET to break out of a program since the facility may not always be in use.
- The existance or otherwise of the RESET facility is not SAVEd. This means that if you SAVE a program which contains an infinite loop, and then LOAD it back at some future stage when RESET is not present then you may find some problems. You can of course SAVE the RESET program itself using SAVE "RESET" CODE 32994,89 and then initiating it as in point (1) above.
- RESET will not work whilst LOADing or SAVEing a program, nor will it work during BEEP.
- RESET will not work if interrupts are disabled. This explains the point above. It is therefore possible to write a machine code program which may not be broken into simply by making the first instruction DI and remembering that you *must* execute EI before returning to Basic.
- The Basic command NEW will deactivate the RESET function, even if the code is stored above RAMTOP. It may of course be reactivated as in the first observation unless NEW has erased the code itself.
- Sadly, the RESET function cannot (as far as I know) be implemented on a 16K machine. This is because the I register cannot hold values in the range 40 to 7F without corrupting the TV screen.

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FLIRTING WITH FORTH

Once the initial association with Sinclair Basic has run its course, Spectrum owners soon come to realise its limitations — especially with regard to speed of operation. Steve Mann checks out alternative routes — in particular the 'FP' and 'IS' compilers from Softek, and the Abersoft Forth package.



MARK ARUNDALE

All Spectrum owners will have noticed that their implementation of, say, *Missile Command* just doesn't have the speed or the smooth, pixel-by-pixel movement that a true arcade game devotee has come to expect from a program. In fact, Basic is just about okay if the display is kept simple — PRINT AT is actually, relatively, quite fast if the number of objects that need to be moved is kept small — but once the number of moving objects reaches four or five, the movement slows down dramatically.

Sinclair's highly individualistic — some might say bloody-minded — method of laying out the display file ensures that direct POKEs to the screen are more trouble than they're worth, so something different is needed. Another drawback is that anything that is moved a character square at a time is going to look jerky when compared with the single pixel steps achieved in professional programs.

WHICH WAY OUT

A recent innovation is the idea of a 'games design' package; Melbourne House has just marketed one of these, as has Quicksilva. But these are necessarily limited — the Quicksilva package, for example, while allowing the designer a fair amount of freedom in manipulation of sprites, insists that the resultant game is of one of four types, described as Space Invader, Asteroids, Scramble or Berserk. If you want a completely new format then, tough, you're out on your own, buster.

Pundits will pontificate patronisingly . . . "Where's the problem?" they'll ask, "machine code will deal with all that and more" — but no one likes a smart-arse, and machine code has a reputation for sending beginners gibbering and whimpering back to the comfort of Basic. It's not that it's amazingly difficult — in fact, in some ways it's extremely simple — but it's not an easy subject to learn from books and early attempts at understanding often prove so offputting that the whole idea gets quietly shelved in the 'forget it' tray.

There has to be an easier way, and there is — in fact there are several. One way out is to learn Forth — definitely the year's most fashionable language for home computer users — and later on in this article we'll be taking a look at the Abersoft Forth compiler for the Spectrum. Another alternative is to use compiled Basic instead of the built-in interpreted version and, as Softek has released new versions of its Basic compiler, it seems only right and proper to give these the once-over.

So, introductory waffle over, it's time now to move towards the highly laudable aim of making life easy for the user. Let's get down to some specifics . . .

THE COMPILER ROUTE

Integer and Floating Point from Softek

Purists may look down on Basic compilers as being something of an easy way out, but then who wants to make things difficult? The principle behind a Basic compiler is perfectly straightforward — just type in your Basic program (or load it from tape or Microdrive), hit a couple of keys and, presto, the 707 has become a space shuttle — at least that's the theory.

Of course, nothing is actually that simple. The manual for the Softek compilers claims that compiled programs will run 'up to' 200 times faster (in some circumstances even 500 faster is possible), but the important point to note is that 'up to' is apostrophised (if there is such a word). In practice you will find that the compiled code is rarely that efficient and your programs are unlikely to be any more than 10 times faster. But let's not be ungrateful, a speed increase of 1000 percent is certainly not to be sneezed at!

The other point to note is that there is a trade-off of speed against ease of use — the Softek 'FP' floating-point compiler offers many more features to the user: it will handle almost all Basic commands and functions, including strings and arrays (single dimension only) and a full range of 'real' numbers. The 'IS' integer compiler has many more restrictions on its use — no arrays, fewer commands and integer numbers only, in the range – 32767 to 32767 (some functions will store a number in the range 0 to 65536 — for example, PEEK, POKE and USR). Floating point numbers are stored in five bytes, whereas integers take up two only — so the IS compiler produces much quicker code than does the FP version; in some cases operation can be speeded up by using the INT function, but generally the FP compiler will run two to ten times faster and in all but optimum conditions the speed increase will be at the lower end of this range.

In most instances, the 'IS' model is perfectly satisfactory, despite its more limited range of facilities, and the speed factor more than makes up for the extra care that is needed to ensure that the Basic is compilable. The lack of floating point maths need not necessarily be a drawback — integer numbers are often quite sufficient and, indeed, most Forth implementations will not handle floating point numbers anyway.

As a demonstration of the comparative speeds of interpreted and compiled Basic, let's examine a very simple program that plots every point on the screen (Figure 1). A couple of FOR/NEXT loops do the job quite adequately and, as can be seen from the timings, the 'IS' compiled version is fastest by many orders of magnitude. In the segment of this review that looks at Abersoft Forth, I have included a Forth version of this routine and a timing for further comparison.

```
10 FOR A = 0 TO 175
20 FOR B = 0 TO 255
30 PLOT B,A
40 NEXT B
50 NEXT A
```

Figure 1. Basic program to plot each point onscreen. Basic takes 6mm 03 secs. 'FP' compiler takes 1min 40secs. 'IS' compiler takes 10secs.

```
10 FOR A =  1 TO 128
20 LET B = (255 – A)
30 REM S, 87, A, A
40 REM S, 88, B, A
50 REM B
60 BEEP 1/50, 1
70 NEXT A
```

Figure 2. 'Mini-sprites' on the 'FP' compiler.

```
 10 CIRCLE 128, 88, 50
 20 LET A = 16384
 30 LET X =  46000
 40 LET K = PEEK A
 50 POKE X,K
 60 IF A > 22528 THEN GOTO 80
 70 LET A = A + 1: LET X =X+1: GOTO 40
 80 CLS: PAUSE 100
 90 LET A =  16384: LET X =  46000
100 LET K = PEEK X
110 POKE A,K
120 LET A =  A + 1: LET X = X + 1
130 IF A > 22527 THEN STOP
140 GOTO 100
```

Figure 3. 'FP' screen dump — this saves the screen above RAMTOP and then downloads the screen. Line 10 is to put the design on-screen (anything will do).

```
: TEST  176 0 DO
        256 0 DO
        I J PLOT
        LOOP LOOP ;
```

Figure 4. This program plots each point on-screen in Forth — it takes just 20secs.

```
: DEMO
  251 0 DO
  125 0 PLOT I 90 DRAW
  125 175 PLOT I 90 DRAW
  15 +LOOP ;
```

Figure 5. Using dictionary words to draw a pattern on-screen.

```
: DEMO 1
  7 0 DO
  I INK CLS DEMO
  5000 0 DO LOOP
  LOOP ;
```

Figure 6. Using the previous example of Figure 5 to define a new word, the pattern then runs through all the INK colours.

MINUS MASTER KEY

Both Softek compilers use the same memory addresses, and both take up approximately 6K of RAM. I had hoped to incorporate Softek's *Master Key* program, which defines the SPACE key as a further SHIFT and which then uses this in conjunction with the numeric keys to give user-definable function keys. Unfortunately *Master Key*, which worked a treat on my earlier Spectrum model, is another fine program that has fallen by the wayside now that Sinclair has started mucking about with the ULA (see Front Lines, Sinclairwatch). Your author's much-loved Issue 2 Spectrum gave up the ghost a few weeks ago and despite having now got a replacement — also categorised as an Issue 2 — affections for the new model are already strained by the number of programs that now fail to work. Sinclair Research may claim that it's all the fault of software manufacturers who have jumped to conclusions about specifications, but one program that resolutely refuses to run on my new machine is Sinclair's own *IQ Test*! Anyway, *Master Key* would have been a boon when used in conjunction with the compiler. It would have enabled Basic programs to be compiled at a single keypress, thus obviating the need to remember the somewhat clumsy RAND USR command needed both to compile and then to run programs. I just hope that Softek produces a revised version for later Issue 2 and Issue 3 machines.

Anyway, even without *Master Key*, Softek's compilers work well enough. The compiler is first loaded and the user is asked if RAMTOP is okay at 40000 (48K version). RAMTOP may be moved to allow many different short routines to be linked together. After typing in the Basic, all that is needed is to key in RAND USR 59300. The compiler makes two passes through the program, printing on-screen the start and end addresses and detailing any errors. Compilation stops at any mistake and the offending line may be pulled down and edited in usual Basic fashion. Once any errors have been dealt with, all that's needed is to make a note of the start address and use this in another RAND USR call to RUN the program. The Basic program remains in memory if desired, so both interpreted and compiled Basic programs may be run.

Initially, all but the simplest programs will probably refuse to compile when using the 'IS' version — but it's not too difficult to rewrite the offending sections to allow for the limitations (arrays will obviously take some thought — one solution is to POKE the required information into spare memory for later retrieval). Only skimpy, provisional documentation was available to work with while writing this review, but Softek assures us that full manuals will be available very shortly. The 'FP' compiler is much less finicky, although it did seem impossible to use a third parameter in a DRAW statement, despite the manual's claims to the contrary.

One particularly nice feature is the use of special REM statements to give commands and facilities not normally available in Sinclair Basic. These include such features as ON ERROR GOTO; ON n GOTO, where n must be a single-letter variable; and, most useful of all, REM S a,x,y which plots the character whose ASCII code is at PLOT position x,y. This REM statement allows some very smooth pixel-by-pixel movement (see Figure 2) and can be used with user-defined graphics to produce mini-sprites.

There were some slight problems with graphics when using the compilers — the Union Jack program from the Sinclair manual, for example, gained some extraneous black blobs when compiled — but there was certainly nothing that could not be put right after a little thought. Hopefully the final version of the manual will go into a little more detail than the preliminary effort — but even with just this, both Softek compilers proved easy to use and gave some impressive results.

It's also nice to see that Softek has dropped its demand for royalty payments on programs that are produced with its compilers — all the company now asks is that the use of a compiler is acknowledged on packages and advert-

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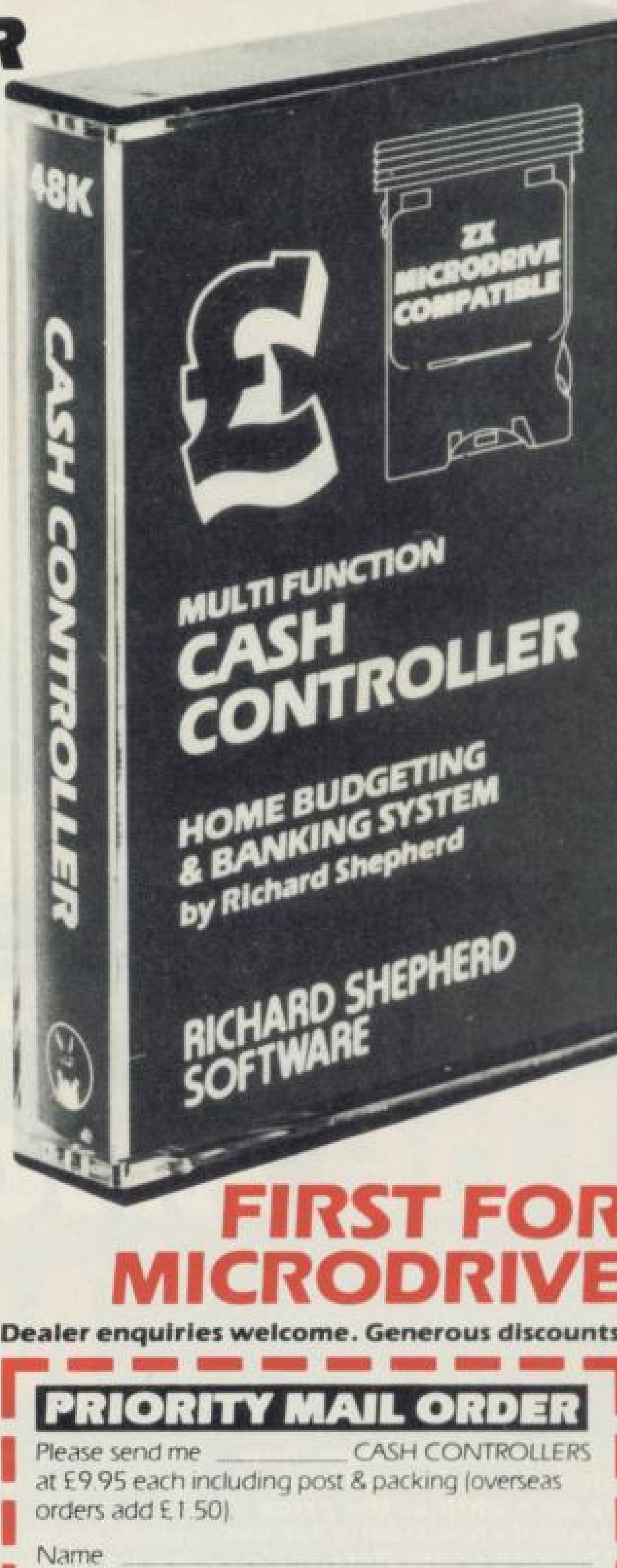
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The 'FP' Compiler costs £19.95, the 'IS' Compiler £9.95 and both together the price is £24.95. You can get them from Softek, Suite 60, 12/13 Henrietta Street, London WC2.

SHIFT INTO FORTH

Abersoft helps trash Basic speed limits

The Forth language was originally developed by Charles Moore in the 1960s as a language for controlling radio telescopes. Since then it's been used for a wide variety of applications, including arcade video games. Unlike Basic, which is usually ROM-based, Forth is generally supplied on disk and, with its sudden surge in popularity over the past year or so, now on cassette too.

The newcomer to the language will notice two major differences between Forth and Basic — Forth uses Reverse Polish Notation (ie. Basic's PRINT 2+2 is replaced by 2 2 + .), and makes great use of the stack for virtually every operation.

There are now many versions of Forth available for the Spectrum — Abersoft's implementation is basically fig-FORTH (the modishly lower case 'fig' referring to the Forth Interest Group) with extensions to handle the machine-specific graphics and sound commands. Forth was originally designed for use on disk-based systems, and the Abersoft version emulates disk operation by setting aside an 11K chunk of memory and using this as a 'pretend' disk. Although 11K does not sound like an incredible amount of memory, the compactness of Forth allows some very complex programs to be developed.

The version looked at here has no provision for Microdrives, but it would be relatively simple to implement these, giving in effect a true (although slow) disk-based system. The 11K of 'RAM-disk' is organised into pages of 1K, each containing 16 lines of 64 characters. This is hardly ideal for the Spectrum's 32-character display but is a Forth standard and, in fact, gives rise to no real problems in use.

HOW IT OPERATES

For those who are totally unfamiliar with the language, it should be said that Forth is used by defining words, using the basic building-blocks of the standard words in the dictionary. Each new word is treated as a new dictionary entry, and further words may be defined by using these. Thus, eventually, a complex program may be defined and run by the typing of a single word.

The stack assumes paramount importance, being used for almost every operation — even to the extent of passing values from word to word and doing the same job as a Basic variable. It is in fact a surprisingly easy language to get to grips with, once the user has grasped Reverse Polish. Words may be defined direct from the keyboard — in which case the definitions go straight into the dictionary; or by using the editor — in which case they are not compiled immediately but wait until the blocks of text from the editor are LOADed.

For most of the machine-specific extensions, Abersoft has stuck to the familiar Basic names, but Reverse Polish means that parameters go before, rather than after, the keyword — the Basic PLOT x,y becomes, for example, x y PLOT (note the absence of a comma). In some cases the familiar words have a slightly different meaning — the Basic DRAW, which uses relative coordinates (DRAW 50,50 would mean draw to a point 50 pixels horizontally and 50 pixels vertically away from the last plotted position) is replaced by absolute coordinates, with 50 50 DRAW meaning draw a line from the last point plotted to the screen coordinates 50,50. The CIRCLE routine in ROM could be called from Forth. The Basic BEEP command is omitted completely, which is a pity. However, the facility exists to insert machine code routines and so the CIRCLE becomes the Forth BLEEP, used in the format n1 n2 BLEEP to produce a tone of duration n1 and pitch n2. User-defined graphics are fully supported, and the manual contains a routine to define any character by using the word UDG.

In addition to the Spectrum graphics and sound extensions, Abersoft Forth supports the Pascal-like CASE structure for handling multiple decisions, and the word FREE which — surprise, surprise! — tells you how many bytes remain free for use.

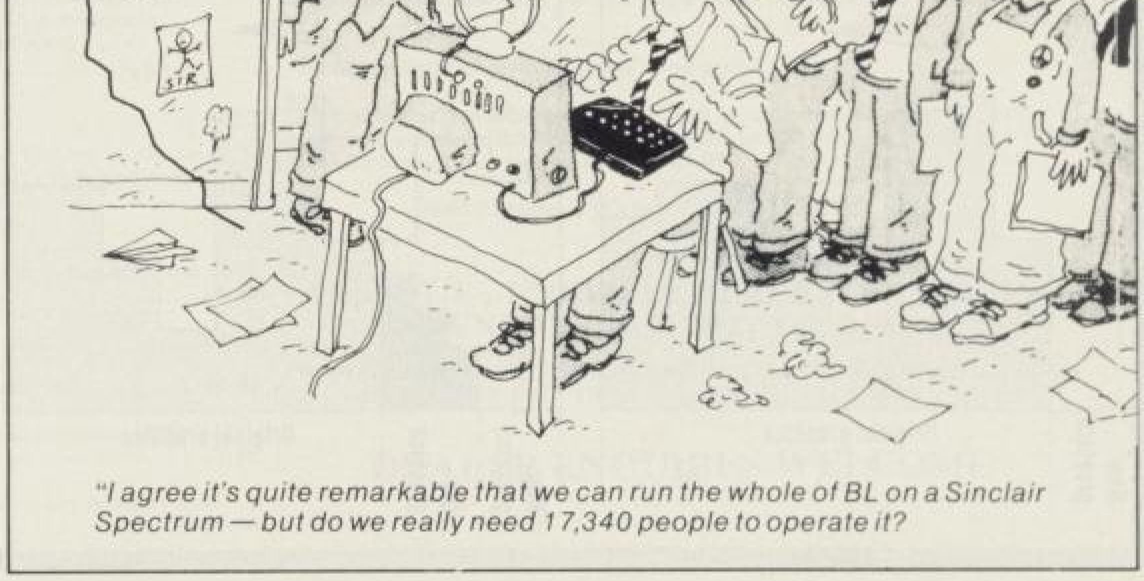
The Abersoft documentation makes no claims about the use of Forth, instead concentrating on the Spectrum-specific extensions and giving a glossary — with a few omissions — of the words in the dictionary. Unfortunately the glossary contains some misprints, but as the novice user will need a proper Forth instruction book, these should not be too troublesome. It's a good idea to supplement the Abersoft manual, and whatever book is decided on for teaching purposes, with the fig-Forth installation documentation; this costs a fiver and is well worth shelling-out for (the contact address is given at the end of this article).

All in all, then, Abersoft Forth is highly recommended for the beginner who wishes to learn more about this fascinating language. With an increase in speed of up to 5000 percent over Basic, Forth provides a good alternative to machine code for fast-running programs and speedy graphics – and its use in arcade machines testifies to its success as a language for the programming of all-action games. It's impossible to give more than a rough idea of the language's capabilities in this short article — but hopefully, at least, your curiosity will provoke you into investigating Forth on your Spectrum.

Abersoft Forth costs £14.95 and is available from Abersoft, 7 Maes Afallen, Bow Street, Dyfed SY24 5BA.

GOOD READING

The Complete Forth — Alan Winfield (Sigma Technical Press)
Discover Forth — Thom Hogan
Forth Programming — Leo Scanlon
Forth installation documentation is available from Forth Interest Group UK, 15 St Albans Mansion, Kensington Court Place, London W8.

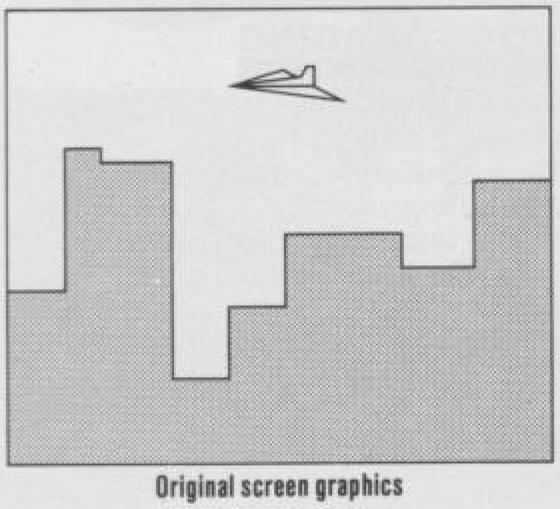


"I agree it's quite remarkable that we can run the whole of BL on a Sinclair Spectrum — but do we really need 17,340 people to operate it?

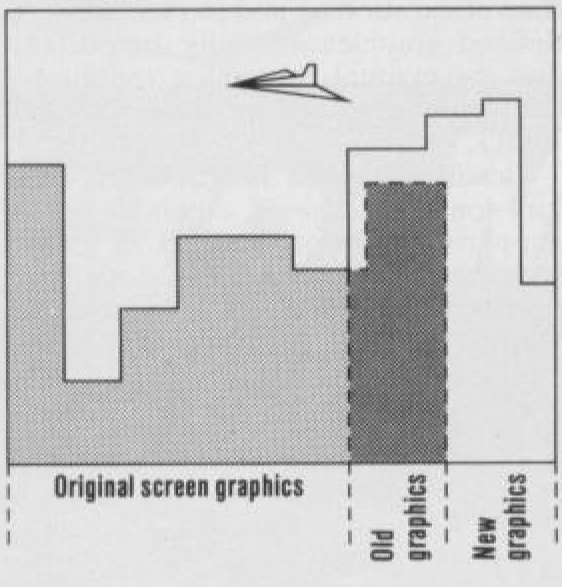
MOVING GRAPHICS OF THE HORIZONTAL KIND

Every now and again you may feel an uncontrollable urge to write some sort of computer program. (There is no known cure for this compulsion, although it has been suggested that long holidays in the countryside might possibly do the trick.) But for instance, what do you do if you want to scroll the screen sideways and haven't the foggiest idea where to start? Well, forget phoning the Samaritans because* Toni Baker *is about to suggest that one answer to many of your problems lies in machine code.

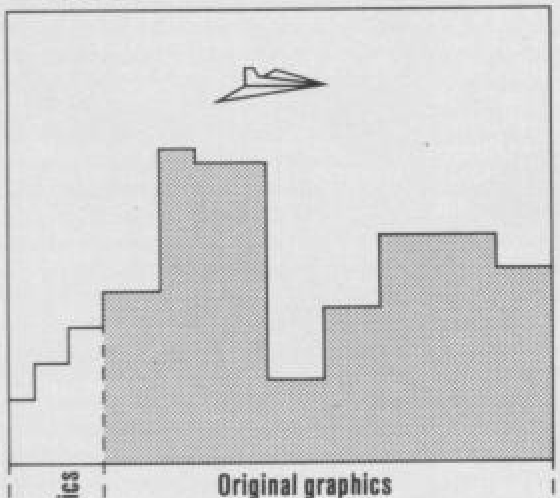
A: SCREEN STATIONARY



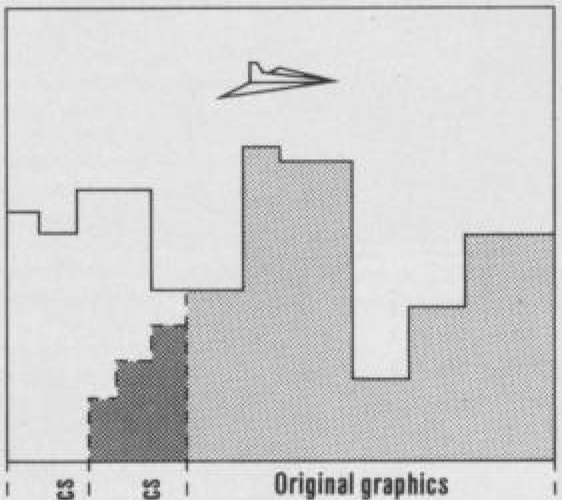
C: SCROLLING LEFT



B: SCROLLING RIGHT



D: SCROLLING RIGHT



MARK WATKINSON

I'll tell you what — type in this Basic program, which is adapted from a program out of *Mastering Machine Code On Your ZX Spectrum* (written by some looney not a million miles from these pages — plug! — and published by Interface).

```
10 INPUT "Machine Code Address";X
20 LET A$=""
30 IF A$="" THEN INPUT A$
40 LET Y=CODE A$ -48: IF Y>9 THEN
   LET Y=Y-7
50 LET Z=CODE A$(2)-48: IF Z>9
   THEN LET Z=Z-7
60 POKE X, 16*Y+Z
70 LET X=X+1
80 LET A$=A$(3 TO )
90 GO TO 30
```

Once Toni Baker's program is successfully up and running, you should get the effect of the screen scrolling first in one horizontal direction and then the other. To give some 'feel' for the movement of the screen image, Toni has incorporated a number of blocks which are drawn to a random size at the base of the screen; in a game of your own, these blocks could (for instance) simulate a city landscape over which you have to fly your space vessel. To illustrate this concept of random building blocks, have a look at the four diagrams, A-D. Say the original screen looks like that in Diagram A; then if the screen scrolls to the right you get a 'new' series of blocks drawn so that the 'city landscape' appears to continue. But if you now look at Diagram C (in which the screen scrolled back to the left) the graphical blocks drawn do not exactly replace the old scenery but are, in fact, random heights (the 'old' landscape is shown in the diagram for comparison). The same effect can be seen in Diagram D, where the screen has now scrolled to the right again. Thus the graphics do not exactly replicate the original landscape, but draw random scenery to give the impression of a continuous landmass.

(Note that in the book, if you have it, there is a mistake on page 13 whereby line 60 should have a plus sign instead of an equal sign).

The program above asks first of all for an address somewhere in RAM which you must input. Run the program and input the number 28801. In hexadecimal this is the number 7081h. The reason that I have chosen this address is because I intend to use all of the addresses from 7000h to 7080h to store various bits and pieces of data, all to be explained in a moment. First though the program. Listed below is a machine code program. All you need to do is type in the letters and numbers in the left-hand column. For instance, you start off by inputting '3A8070' and then '3C' and then 'E67F'. When you have got through the entire listing you should press EDIT (CAPS SHIFT and 1) to delete the quote marks, and then STOP (SYMBOL SHIFT A) without quotes, and then ENTER, and this will break out of the program.

For those of you who understand machine code, I have also included in the middle column a listing of the machine code program itself, and in the right-hand column some comments on what the program does. If you don't understand machine code it doesn't really matter — all you need to do is type in the stuff in the left-hand column only. OK, here we go. Note that all the '0's are in fact zeros, and all the '1's are in fact ones.

Now we have to fill up those areas of data. Erase the Basic program one line at a time (not by typing NEW) and now enter this program instead:

```
10 FOR I=28672 TO 28800
20 POKE I,INT (9*RND)
30 NEXT I
```

This serves the purpose of storing a random number between zero and eight in each address from 7000h to 7080h. Now erase those lines and input this Basic program:

```
10 FOR I=1 TO 200
20 RANDOMIZE USR 28801
30 NEXT I
40 FOR I=1 TO 100
50 RANDOMIZE USR 28826
60 NEXT I
70 GO TO 10
```

When you now run this program you should get an interesting effect. Line 20 actually scrolls the screen to the left, and line 50 scrolls the screen to the right. Both of these will also draw in a new left- or right-hand edge as required. The data in addresses 7000h to 707Fh store the heights of the various ground features, and address 7080h is used to keep a record of whereabouts the screen is in relation to the horizon. If you add two more lines of Basic:

```
25 PRINT AT 10,10;" −+− "
55 PRINT AT 10,10;" −+− "
```

you will see that you have the start of a simple game. To work out in Basic the height of the ground feature in column X of the screen (with the leftmost column being 0 and the rightmost being 31) I suggest you use the following subroutine which returns the height as Y:

```
2000 LET Y=28672+PEEK 28800
2010 IF Y>28799 THEN LET Y=Y−128
2020 LET Y=PEEK (X+Y)
2030 RETURN
```

And to change the height of column X to height A:

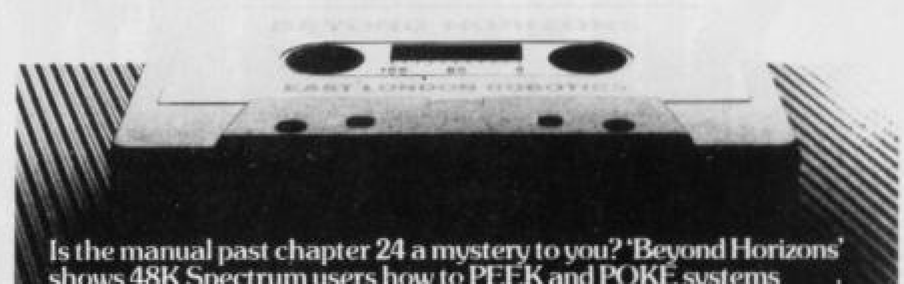
```
3000 LET Y=28672+PEEK 28800
3010 IF Y>28799 THEN LET Y=Y−128
3020 POKE X+Y,A
3030 RETURN
```

Do have fun. What you make out of this routine is entirely up to you but it should certainly keep you amused.

Machine code		Assembler	Comments
3A8070	LEFT	LD A,(POSITION)	A:= co-ordinate of left-hand edge of screen.
3C		INC A	
E67F		AND 7F	
328070		LD (POSITION),A	Move screen right along data.
F5		PUSH AF	
210140		LD HL, 4001	HL:= second byte on screen.
110040		LD DE,4000	DE:= first byte on screen.
01FF1A		LD BC,1AFF	BC:= number of bytes in screen less one.
EDB0		LDIR	Scroll screen left.
0E1F		LD C,1F	C:= co-ordinate of rightmost column.
1815		JR CONT	
3A8070	RIGHT	LD A,(POSITION)	A:= co-ordinate of left-hand edge of screen.
3D		DEC A	
E67F		AND 7F	
328070		LD (POSITION),A	Move screen left along data.
E5		PUSH AF	
21FE5A		LD HL,5AFE	HL:= second to last byte on screen.
11FF5A		LD DE,5AFF	DE:= last byte on screen.
01FF1A		LD BC,1AFF	BC:= number of bytes in screen less one.
EDB8		LDDR	Scroll screen right. C:= 00.
2640	CONT	LD H,40	
69		LD L,C	HL:= address of first row segment to erase.
112000		LD DE,0020	
06C0		LD B,C0	B:= number of rows in screen.
3600	ERASE	LD (HL),00	Erase next row segment.
19		ADD HL,DE	Point to next row segment to erase.
10FB		DJNZ ERASE	Repeat for all rows.
0618		LD B,18	B:= number of lines in screen.
3A8D5C		LD A,(ATTR_P)	A:= attribute byte.
77	NEW_ATTRS	LD (HL),A	Change next attribute byte.
19		ADD HL,DE	Point to next attribute position.
10FC		DJNZ NEW_ATTRS	Repeat for all attributes in column.
F1		POP AF	A:= co-ordinate of left of screen.
81		ADD A,C	
E67F		AND 7F	A:= co-ordinate of column just erased.
6F		LD L,A	
2670		LD H,DATA high	HL:= points to corresponding data byte.
46		LD B, (HL)	B:= height of ground.
3EE0		LD A,E0	
81		ADD A,C	
6F		LD L,A	
2657		LD H,57	Point HL to last row segment in column.
04		INC B	
05		DEC B	
C8		RET Z	Return if height equals zero.
11E007		LD DE,07E0	
3E08	GROUND_1	LD A,08	A:= number of row segments per square.
36FF	GROUND_2	LD (HL),FF	Draw in ground.
25		DEC H	HL: points to next row segment.
3D		DEC A	
20FA		JR NZ,GROUND_2	Draw whole square.
19		ADD HL,DE	Point to bottom row segment of next square.
10F5		DJNZ GROUND_1	Repeat for required number of squares.
C9		RET	

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EAST LONDON ROBOTICS

“sp[ee]ki[ng] of spe[c

Human speech is essentially a subset of sound synthesis in its broadest sense; that is, if you have control over pitch, waveform and amplitude then it's possible to synthesise any sound, including speech. In practice, total sonic shapers are very sophisticated microcomputer systems in their own right, and hardly add-ons to interest the home computer enthusiast. The Spectrum user is basically restricted to the commercially available chips (or chip sets) which enable a host microcomputer to synthesise speech.

The most common method of synthesising speech today is by the technique known as Linear Predictive Coding (LPC for short). This is basically a memory-compression technique to allow stored speech to be 'played back'. Using this method, about 15 seconds of speech (usually single words) may be stored in a 2K EPROM. The disadvantage of this technique is that although the words are of superb quality, they are 'burned in' — ie. they cannot be altered. You are stuck with the vocabulary you have programmed into your EPROM and a great deal of processing is required on a raw speech input before it can be committed to computer memory in a form suitable for LPC. A typical portable speech development system costs around £8000, effectively putting it beyond the reach of home computer enthusiasts. The raw speech input first has to be digitised. Harmonic analysis is then performed on it and undesirable elements filtered out. Finally the digital information has to be LPC processed and put into the EPROM in a *serial* form.

To overcome this problem, some manufacturers have taken an LPC chip, added some internal ROM, and programmed the chip not with words or phrases, but with *allophones*. These are fragments of speech which, when run together with other allophones, make intelligible speech. Thus, you are not restricted to your burnt-in vocabulary, but can synthesise any word within the limits of your 'allophone set' — the speech sounds you can choose from.

Mark Anson B.Sc. is project manager for computer peripherals at Currah Computer Components Ltd, makers of the MicroSpeech speech synthesis device. The opinions expressed in this article are the author's own and not necessarily those of Currah.

For the purposes of this article, we use as an example the General Instruments SP-0256-AL2 chip — an allophone synthesis chip with an allophone set of 64 speech sounds. These 64 sounds may be run together in any combination under the control of a host microcomputer system, for instance the Spectrum. The sounds may be divided into groups which linguists call 'nasals', 'fricatives', 'labials' and so on, but a simpler division into five main groups will suffice:

Phonetic sounds
These are the simple sounds: a (At), b (Bat), and c (cow); that one may have been taught to read with at primary school.

Strong phonetic sounds
These are similar in pronunciation to the above sounds but have extra emphasis added for use at the start or end of words. For instance, the 'd' at the start of 'day' is different to the 'd' at the end of 'word' (linguists call these positions word-initial and word-final).

Long vowel sounds
The 'ay', 'ee', 'eye' and 'oh' sounds.

Complex sounds
These cover complex, long sounds such as 'th', 'sh', 'uh', and so on.

Pauses
Pauses of various length which enable sentences to be made.

To implement an AL2 system on your Spectrum, first, of course, the chip needs connecting up so that the Z-80A processor in the Spectrum can issue commands and read back status from the chip. The 64 allophones only require a 6-bit address, and to make the chip 'speak' all you have to do is 'present' six bits of data to the correct pins on the chip and drive the 'address load' pin low (logic zero). A convenient way of doing this is to make the AL2 occupy one of the 256 possible 'ports' allowed on the Z-80A.

Upon execution of the machine code instruction: OUT a,(PORT), the contents of the accumulator are written to whatever device is occupying the port location specified by the instruction. The decoding logic between the processor and speech chip is then enabled and the data finds its way to the correct pins on the chip, and further logic drives the address load pin low.

So now the chip is busy speaking an allophone. But suppose you want to output another allophone to make a word. You cannot just go and output another address to the speech chip while it is busy — if you do, the allophone being spoken will be chopped off and the new one started. To guard against this, the AL2 helpfully provides a 'busy' signal on one of its pins, and the Z-80A can read the status of the chip by an IN instruction, and the logical state of one of the data bits in the byte read in will determine whether the chip is busy or not.

Alternatively, to make a system with less software overhead, the external logic can allow the Z-80A to output an allophone. But, as soon as it is issued, the Z-80A can be forced into a 'wait' state until the chip is ready again. In this condition, the processor just sits and (effectively) does nothing whilst the chip is busy speaking.

The Currah MicroSpeech uses a gate array (a semi-custom chip) to do all these housekeeping tasks without putting the Z-80A into a 'wait' state or slowing down the Basic significantly.

Whatever method is used, the speech output from the chip has to be processed and amplified before you can hear it. It comes from the chip in a rather interesting form known as pulse width modulation (PWM for short). This is basically a square wave output which can have a variable mark/space ratio (see Figure 1) and, when 'averaged' by external analogue circuits, a waveform is obtained (Figure 2). The PWM technique generates undesirable 'aliases' (high frequency noise) in the waveform, and the raw wave is processed by filters before being amplified.

THE SOFT APPROACH

Having looked at the hardware, now it's time to turn to the software aspects of a speech synthesis system. Obviously it's

ck]t[rr]ums”

Adding speech to your Spectrum opens up a whole new dimension for experimentation. No longer do games programs have to be silent events filled with the occasional computer-generated snap, crackle and buzz.* Mark Anson *gives an introductory guide to speech analysis on home computers.

highly unsatisfactory to have to keep outputting raw numbers to the speech chip — think how much better it would be if you could just type in letters and have the software translate them into allophones for you! Unfortunately, this is not quite as simple as it appears. Text To Speech (TTS for short) is an area under intensive research for incorporation into the so-called Fifth Generation machines as it includes many features associated with artificial intelligence.

For instance, suppose you wanted to pronounce the word 'female' in a sentence and convert it to the relevant allophone codes for output. The simple program (let's call it Level 1) will scan across the word from initial space to final space and pronounce it phonetically, ie. by considering each letter in isolation. The word would come out rather like 'femalleh'.

Another program (let's call it Level 2) will compare the word with a table stored in its memory and pronounce it correctly. The only trouble is that if it cannot find a match for the word under consideration, it will pronounce it phonetically by default.

A more advanced program (Level 3) will realise that the 'e' at the end of a word such as this lengthens the initial 'e' to an 'ee' sound, and that the 'a' in the middle is a long 'ay' sound. The word will thus be pronounced correctly.

A Level 3 TTS program represents quite a sophisticated processing task, and there are all sorts of horrible anomalies to account for. For instance, how do you deal with 'plough' or 'bough', and yet still get 'trough' right?

The problem gets even more severe when the pronunciation of a word depends on its context in a sentence. For instance, take the statement: 'We lead the world in lead pipe manufacture'. How do you know the correct pronunciation of 'lead'? The Level 4 TTS program incorporates 'context scanning' where the sense of the word is defined by the other words preceding or following it. The human brain can take in this sort of information and pronounce the word correctly because it knows what the sentence means — the computer cannot know the meaning of the sentence (and hence the pronunciation) unless it posesses some degree of artificial intelligence.

A sensible alternative to the fully-fledged TTS system is to include an interpreter which will scan a string of symbols and convert them into allophones (the technique used in the Currah MicroSpeech unit). The Basic string variable, S$, is reserved for use by the system and whenever anything is put into S$, the interpreter scans the string and converts the symbols into speech sounds. The interpreter assumes that any letter not enclosed in brackets is to be pronounced phonetically and exceptions are defined as letters enclosed in brackets.

For instance, the strong phonetic 'l' is symbolised by (ll) and the long vowel 'o' sound by (oo). Thus 'he(ll)(oo)' is correctly pronounced as 'hello'.

The actual choice of symbols used is quite arbitrary; one could equally well set up the standard phonetic symbols (such as the upside-down A and the AE combined) in the user-defined graphics area and use those as the allowed symbols, but this soaks up space which may be required for games. The technique employed in the MicroSpeech unit was to make the symbolisations look how they sound, so that allophone 51 (an 'er' sound) is symbolised by (er) and allophone 5 (an 'oy' sound) is symbolised by (oy).

A particularly tricky one was the (dth) allophone. This sounds like the 'th' in 'there' and not like the 'th' in 'think' — the (dth) symbol eventually decided on was the best symbol which was short enough to be easily remembered and yet made sense when written down.

The symbols look a little strange on first sight, but once you get used to them they are a lot quicker to program with than by outputting numbers to a port. For instance: (dth)iss iz (ee)z(ee)u (dth)an y(ouu)zi(ng) (aa) p(or)t.

You see how you have to think in terms of how the words are spoken rather than how they are written; but this applies equally to a numbers-only system and the symbols are more easily memorised than numbers. And we included a syntax checking program in the on-board software to help users through the initial phases of learning to program in allophone symbols — to give error diagnostics should a mistake be made in syntax.

A criticism commonly levelled at allophone synthesis is that, whilst perfectly intelligible, it lacks life and is rather dull and flat. Intonation is a feature found on some allophone synthesis systems which helps overcome this disadvantage. You can specify whether you want an allophone to be raised slightly in pitch (or even lowered slightly on some systems) by using intonation symbols. A common method of doing this is to use '+' and '−' symbols before an allophone. The MicroSpeech, with its two levels of intonation, uses a slightly different system whereby a symbol in *upper case* is intoned up and a symbol in *lower case* is left alone.

In many ways, allophone synthesis has a lot more going for it than the other methods of speech synthesis, which are basically advanced methods of replaying a pre- recorded signal. But there is definitely room for improvement in the chips currently available, and a 'super-allophone' chip (or chip set) would have such features as 200 allophones to choose from, an 'attributes' port for intonation, volume and pitch of every allophone, and even incorporate some on-board software so that the allophones would run together smoothly with the minimum of software overhead from the host computer. A device like this would enable even the smallest computer to synthesise speech which had both life and character — producing sounds almost indistinguishable from human speech itself.

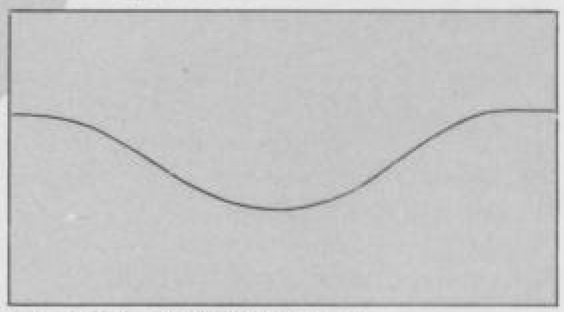


Figure 1 A PWM signal.

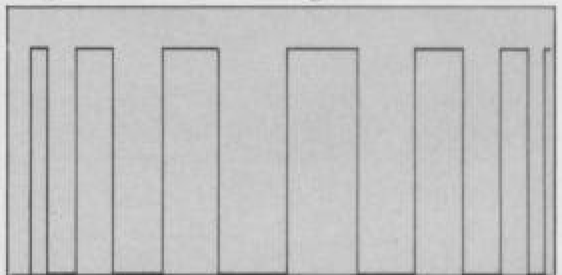


Figure 2 The signal after 'averaging'.

TALK TO ME, OH MICROSPEECH

One of the great things about speech synthesis add-ons is that, for one reason or another, they usually give your computer an unrivalled capacity to make people laugh.* Maggie Burton *discovered that Currah Computer Components's* MicroSpeech *turned out to be no exception.

A *MicroSpeech* unit is about the size of two Swan Vesta matchboxes stuck together by their striking edges, it's matt black (you have to keep the colour scheme consistent with Uncle Clive's tastes) and very light. Actual dimensions are 75mm wide by 70mm deep by 17mm high. It clips into the printer/expansion port at the back of the Spectrum and, of course, it's compatible with the whole range of extras — printer and interface *et al* — so there's no worry about being unable to list out hard copies of programs while the *MicroSpeech* is in use.

The unit is made to function by redirection of the sound output to the TV loudspeaker. Instead, the TV lead is plugged into a hole in the *MicroSpeech* and an output lead from the *MicroSpeech* then completes the exchange by plugging into the usual TV port.

Following switch-on, it isn't long before you notice that every Spectrum key you press is 'voiced' by the computer. The fact that it says 'norrt' rather than 'nought' is just a mere distraction. You can, however, switch these 'key-voices' off by typing LET keys=0; LET keys=1 turns back them on again. Although this could presumably be useful for someone with visual disabilities, one cannot help but envisage problems with the Spectrum's SHIFT keys — which are not voiced. It's also of little help in editing, so a blind computernik would still have a lot of problems putting his or her verbal creations into RAM.

Speechfreaks (try getting the device to say that) are likely to be only too well aware of the fiddly nature of many speech synthesis devices. Most of them are better programmed in assembler for full effect; not so with *MicroSpeech*. It works on the basis of an allophone set rather than the use of smaller phonemes or libraries of words and bits of words. Any contact with addresses/contents of addresses/pushing stacks is reserved for real hackers. In short, machine level work is not necessary. You can make it chat away quite happily from Basic.

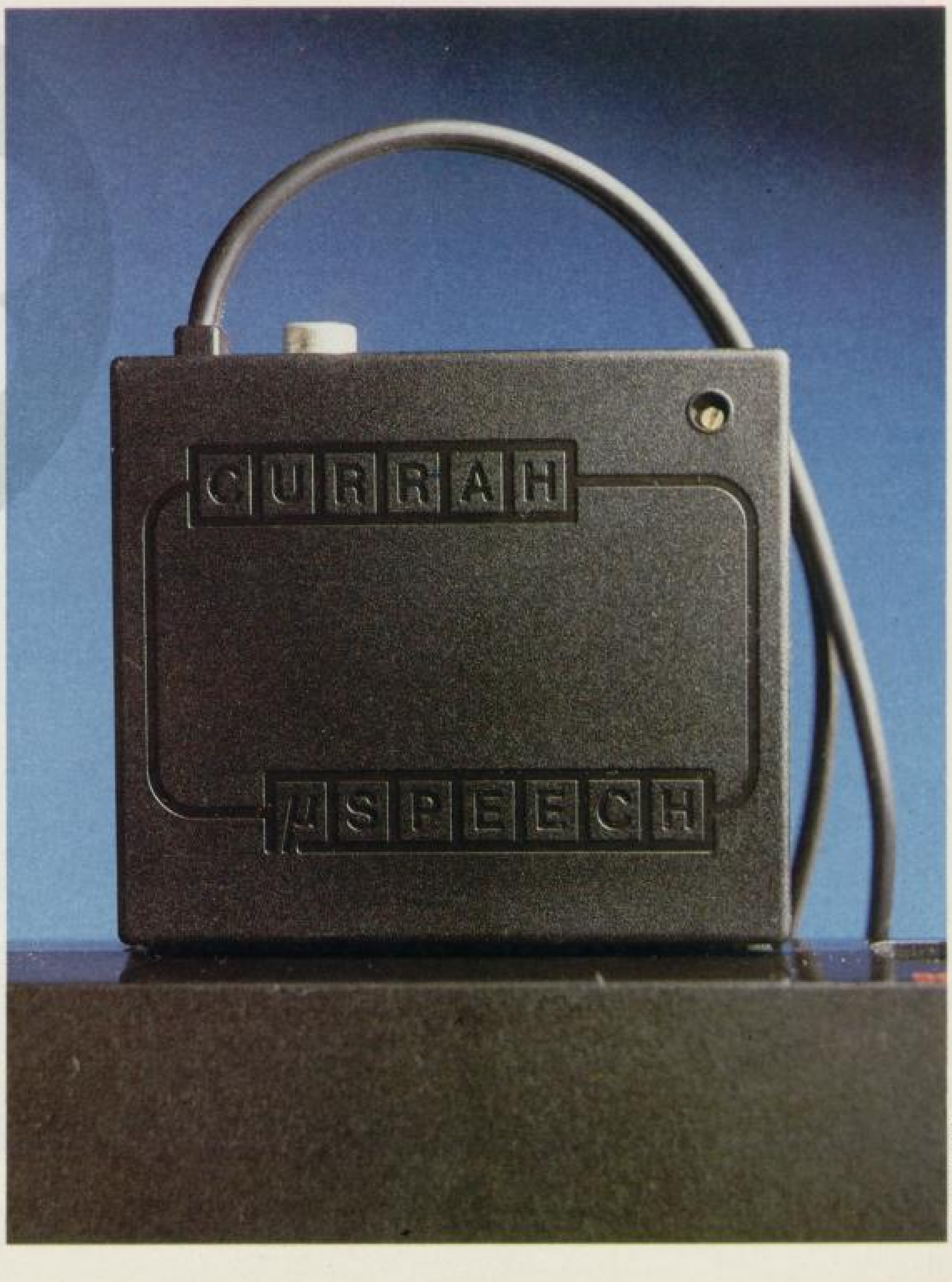
Each allophone produces a distinct, different sound. The five vowels make the 'school alphabet noises' — Ah, Eh, Ih, Oh and Uh. Combinations of vowels produce different sounds. Single consonants are phonetic. Strong phonetic allophones are double consonants and complex allophones are noises like 'th', 'ch' and 'ear'. They and the strong allophones are enclosed in brackets. The brackets distinguish these sounds from groups of phonetic allophones. Leaving the brackets out of the allophone (ggg) (a strong 'G' as in GOTO) will produce something like 'g-g-g' — a new complaint known as the silicon stammer. Altogether there are 58 allophones and they're designed to cater for every sound in the English language. Naturally, heavy compromises are necessary and, for instance, 'q' and 'x' are not recognised because they can be made up of combinations of other sounds — 'kw' for 'qu' and 'ks' for 'x'.

Thus, in making up a sentence it is necessary to see the word exactly as it is pronounced, not as it is spelt. Even then it's possible to get the wrong end of the stick —'th', for instance, should be '(dth)'. But there is also a '(th)' — a slightly softer '(dth)'. Knowing which to use is all down to trial and error.

Those whose knowledge of Sinclair Basic is reasonable should get to know how the *MicroSpeech* works pretty quickly. And it's possible to build up libraries of useful phrases by putting them in string variables (from Basic all words to be spoken are treated as strings). You can then use these over and over again, like this:

```
 5 REM OKAY WISEGUY THIS IS IT
10 LET a$=" (oo)K (AA)"
20 LET b$="w(ii)z (ggg) (ii),"
30 LET c$=" (dth)is iz it"
40 LET S$=a$+b$+c$
```

Line 40 is the line which does the talking and S$ is a reserved variable which, when used, sends all those carefully planned allophones whizzing off to the speech buffer. But note that if the *Mic-*



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roSpeech doesn't recognise one part of a LET S$ statement it'll maintain an eerie silence or skip that phrase and jump to the next one it does understand. Notice the use of the capital 'A' in line 10. Using a capital letter on a vowel raises the pitch at which that vowel is pronounced. A limited amount of intonation is possible in this way — but beware; one of the best ways of confusing the *MicroSpeech* is to use a capital consonant. Even the versatile human voicebox can do little about raising or lowering the pitch of the sound 'P' for instance.

Pauses of various kinds can be included with the help of a space, comma, apostrophe or full stop. The apostrophe is useful for giving emphasis to a bit of a word, as in d(oo)n' (tt) — don't — by shoving a discreet and very short pause in where the apostrophe is placed. The space separates words, the comma, phrases, and the full stop separates sentences. A PAUSE command has to be placed between each LET S$ command and the one following. This makes sure the computer can detect each one. If a PAUSE is left out (it need only be PAUSE 1) the S$ command following where the PAUSE should have been (with me so far?) is omitted.

One complaint is the amount of interference the *MicroSpeech* causes on the TV. It makes it more difficult to tune in properly and all the time the machine is switched on, the TV performs its own impersonation of a beehive. This varies in intensity according to what's on the screen and is at its worst when a program has been listed.

Some of the voicing is very unclear. For instance 'g' and 'd' sound very much the same and there's no real way to get nuances of pronunciation into what the *MicroSpeech* will say. So don't expect it to read too well from Shakespeare or the Gospel of St John

A good list of packages is available, which make interesting use of the Microspeech's capabilities.

[redacted]

— although it's been tried, with predictably silly results. Certainly experimentation is necessary to work out some words although the small-but-perfectly-formed manual is fairly helpful in this direction, providing details of how some of the keywords are voiced and giving some pretty stock-in-trade examples.

It's also possible to connect the *MicroSpeech* to a tape recorder, through a line lead adjacent to the TV connector. Using this it's possible to record speech as it leaves the computer — just plug the lead into the 'MIC' socket of the tape recorder. And by the same token, output to a hi-fi is possible by connecting the same lead to the auxiliary socket of an amplifier.

The speech chip used in the Currah *MicroSpeech* is General Instruments' SP0256-AL2. Currah and GI worked quite closely together on the project and the end result (at £29.95) is an absorbing, easily used add-on which represents pretty good value in an age of destitution and hardship. It's available, Sinclair-style, by mail order from Currah and comes complete with a demo cassette. It can also be bought through Spectrum Computer centres, Computers For All and Comet. WH Smith and Boots will probably get round to it eventually as well.

Several software houses have quickly cottoned on and a good list is available of packages which make interesting use of the *MicroSpeech's* capabilities. This includes, from Bug-Byte, *The Birds and the Bees*, from Artic, *Talking Chess*, and from Romik, a version of *3D Monster Maze*. To date, claims Steve Currah of Currah Computer Components, "about 20,000" *MicroSpeech* units have sold, mainly to stores. No wonder — it's good fun and great value.

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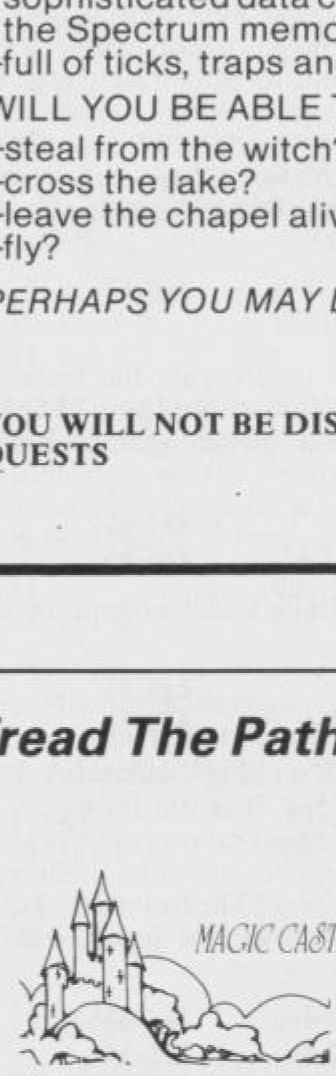
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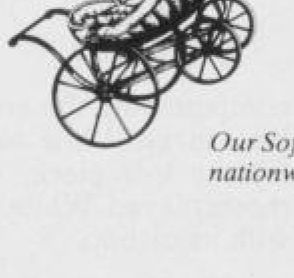
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CROSS CHECK

With tongue-in-cheek seriousness, YS recently organised an unusual chess tournament, one that featured many of our favourite Spectrum chess programs — each playing the other. We commiserate with* Jonathan How *for having to preside over the (at times excruciating) games, and thank grand master,* Dr John Nunn, *for compiling this analysis and report.

Regarded as an intellectual and rather sophisticated pursuit, chess was an obvious choice for enterprising software engineers to implement on the home computer. And over the years of trial and error, the chess packages now available for the ZX Spectrum are many and varied. But then, everyone has their own personal favourite when it comes to facing a 'soft' opponent across the chess board. So, why not play some of the packages against each other and see which one comes up the winner?

Picture, if you will, two Spectrums side by side, each intent on outwitting the other at one of the oldest games in the world. The five combatants were ammassed — Artic's *Super Chess II*, CP Software's *Super Chess* and *Super Chess II*, Micro Gen's *Master Chess* and Quicksilva's *The Chess Player*. But that's when the problems began . . .

How do you find a compatible level on which to play the packages against each other? For instance, *Super Chess* and *Master Chess* each have ten levels of skill to contend with, and *Super Chess II* allows the player to select the length of time taken between moves — from one second to 16 hours!

For obvious reasons of time, the games in this mini-tournament were played with the programs set to a relatively low level. At a tournament time limit of two to three minutes per move, the standard of play would be considerably higher than in the extracts of play given below.

Despite the limitations of quick play, Artic's *Spectrum Chess II* emerged a convincing winner. There was only one game in which *Spectrum Chess II* found itself in serious trouble, but in the end it was unlucky not to have won! Here is the game in question:

ABBREVIATIONS

Pawn	No Symbol
Knight	N
Rook	R
Bishop	B
Queen	Q
King	K
+	Checks
x	Captures
0-0	Castles (king side)
0-0-0	Castles (queen side)

GAME 1

White: *Spectrum Chess II,* Artic.
Black: *Super Chess,* CP Software.

1	f2-f4	d7-d5
2	Ng1-f3	Nb8-c6
3	Nb1-c3	Ng8-f6
4	d2-d4	Bc8-d7

4 . . . **Bc8-f5** was much better, as Black realises the next move.

5	Bc1-2	Bd7-f5
6	e2-e3	Nc6-b4

The attack on c2 can only be met by **7 Ra1-c1**. Instead, White blunders a piece away:

7	Nc3-e4?	d5xe4
8	Bd2xb4	e4xf3
9	Bf1-b5+?	

compounding the error. **9 g2xf3** would have given White some compensation for the lost piece, whereas after the move played White has to waste time with its bishop.

9	. . .	c7-c6
10	Bb5-f1	f3xg2
11	Bf1xg2	a7-a5
12	Bb4-c3	e7-e6
13	0-0	Bf8-e7
14	Qd1-d2	Qd8-b6
15	Ra1-d1	0-0
16	Rd1-e1	Bf5-g6?

Black's first sign of hesitation. Its extra piece guarantees the win with correct play, but here it was important to prevent White's central advance, **e3-e4**, by occupying e4 with a bishop or knight.

17	e3-e4	Qb6-b5
18	e4-e5	Nf6-e8?

Here the knight not only has no active prospects itself, but it also immobilises the rook at f8. **18** . . . **Nf6-d5** was much better.

19	Re1-e2	Bg6-f5
20	Rf1-e1	h7-h6
21	b2-b3	Be7-a3
22	Qd2-e3	

White has been gradually improving its position to the extent that Black's task of exploiting its extra piece requires careful play. However, Black now starts a suicidal king march into the heart of White's position. *Super Chess* seemed prone to attempting regicide, since the same thing happened in another game against *Master Chess*. Curiously, *Super Chess* survived on both occasions by remarkable pieces of good fortune!

22	. . .	Kg8-h7
23	Bg2-h1	

Rather than incarcerate the bishop in the corner, White should play **23 Bg2-f1**, with a veiled threat against Black's queen.

23	. . .	Kh7-g6?
24	Re2-g2+	Kg6-h5?

This was Black's last chance to turn back by

24	. . .	Kg6-h7
25	Qf3-g3+	Kh5-h4

With Black's king surrounded by White's pieces, it is hardly surprising that there are several ways for White to force a quick mate. The neatest is **26 Re1-e3** (threat **27 Bc3-e1** mate) **Ba3-b4, 27 Qf3-g3+Kh4-h5, 28 Qg3-h3+Bf5xhx, 29 Re3xh3** mate.

26	Qf3-g3+	Kh4-h5
27	Qg3-f3+	Kh5-h4
28	Qf3-g3+	

Thus, missing the mate for the third time. The game now ended in a draw by repetition as White checked on f3 and g3 forever. All the programs suffered from this tendency to force a draw in a winning position. Evidently some quirk in the evaluation of the positions would convince the program that it was making the best move each time, but there was nothing to tell it that no progress was being made. Sometimes this led to ludicrous situations. In *Chess Player* v *Master Chess*, the *Master Chess* program couldn't win with king, queen and four pawns against a lone king because it gave a series of aimless queen checks which eventually led to a draw by repetition. Other faults which cropped up several times were reckless exposure of the queen early in the game and failure to appreciate in good time that pawns arriving on the eighth rank become queens!

The next game was the best in the

tournament and effectively decided the winner.

GAME 2

White: *Super Chess II,* CP Software.
Black: *Spectrum Chess II,* Artic

1 d2-d4	Ng8-f6
2 c2-c4	e7-e6
3 Bc1-g5	d7-d5
4 c4xd5	Bf8-b4+
5 Nb1-c3	Qd8xd5
6 Bg5xf6	Bb4xc3+

Black is right to interpose this exchange before recapturing on f6 since the immediate **6 ... g7xf6** gives White a promising position after **7 Qd1-a4+ Nb8-c6, 8 Qa4xb4! Nc6xb4, 9 Nc3xd5 Nb4xd5, 10 e2-e4**.

7 b2xc3	g7xf6
8 Ng1-f3	Nb8-c6
9 Qd1-d3	

White is aiming to complete its pawn centre by playing **e2-e4** and Black should have stopped this threat by **9 ... f6-f5**.

9 ...	0-0
10 e2-e4	Qd5-d6
11 0-0-0	

Castling queenside is very risky as White's pawn structure is badly broken in that part of the board. **11 Bf1-e2** followed by kingside castling would have been safer.

11 ...	Qd6-a3+
12 Kc1-b1	Bc8-d7

For the moment White's king is safe since Black's pieces cannot easily come into the attack, but the dangerous position of Black's queen is ominous.

13 d4-d5	e6xd5
14 e4xd5	Nc6-e7

Black threatens **15 ... Bd7-f5** winning White's queen, but White avoids this trap.

15 Qd3-d4	Qa3-d6

Black's queen comes back to defend the f6 pawn, but in doing so abandons the prospect of an attack on White's king. **15 ... Ra8-d8!** Sacrificing the pawn would have been better since **16 Qd4xf6 Bd7-f5+, 17 Bf1-d3** (or **17 Kb1-a1 Rd8xd5** when **18 Rd1xd5** allows **18 ... Qa3-c1** mate) **Rd8-d6, 18 Qf6-g5+ Rd6-g6, 19 Qg5-c1 Rg6-b6+, 20 Kb1-a1 Qa3xc1+, 21 Rd1xc1 Bf5xd3** wins a piece for Black.

16 Bf1-e2?	

White errs in its turn. **16 Bf1-d3** was essential, to prevent Black's bishop coming to f5 with check.

16 ...	Bd7-f5+
17 Kb1-b2	Rf8-d8
18 g2-g4	

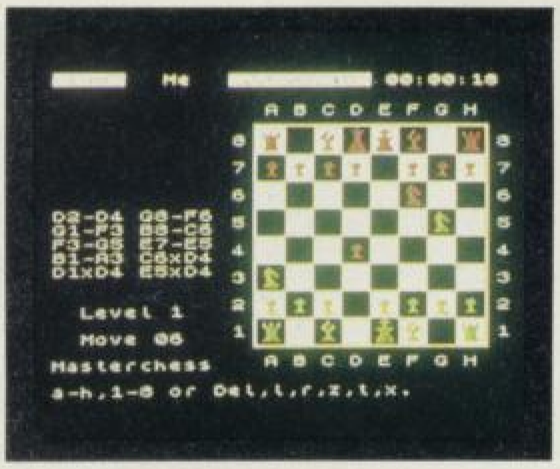
White later has cause to regret this weakening move.

18 ...	Bf5-g6
19 Be2-c4	c7-c6!

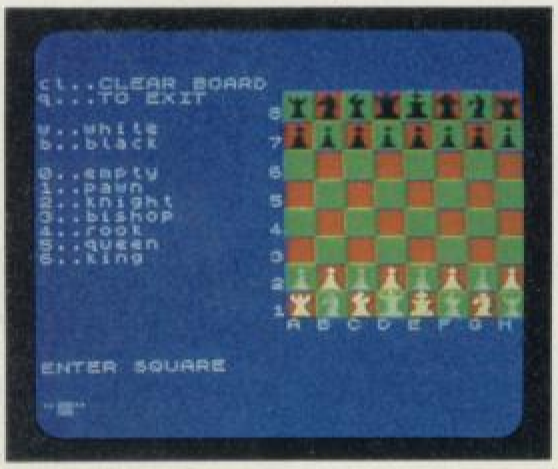
An excellent move which wins material by force.

20 d5xc6	Qd6xc6
21 Qd4xd8+	Ra8xd8
22 Rd1xd8+	Kg8-g7

Two rooks are worth slightly more than a queen, so on a strict material count White is ahead at the moment. This won't last for long, however, since the f3 knight and c4 bishop are both under attack by Black's queen, and if White defends both by **23 Bc4-e2** Black unleashes its third threat of **23 ... Qc6-b6+** forking king and rook. White cannot

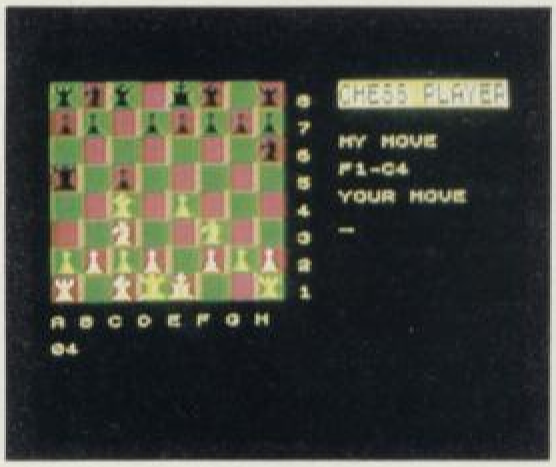






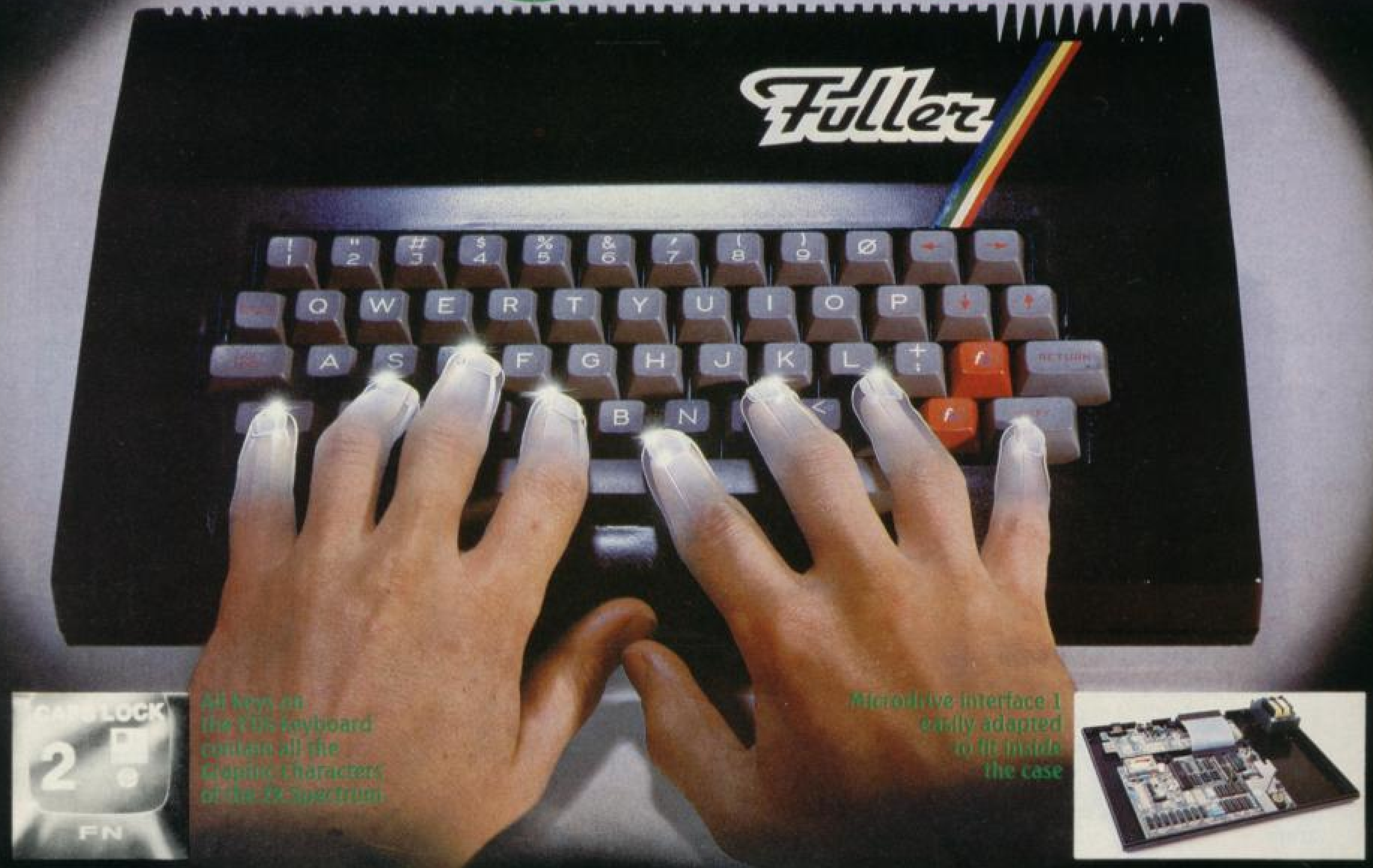


Here above are screen illustrations of the chess programs which so valiantly did battle for the sake of this article. Looking from left to right from the top, we have CP Software's Super Chess II, Artic's Spectrum Chess II, CP Software's Super Chess, Micro Gen's Master Chess and last but not least, Quicksilva's The Chess Player. As can be seen from the photographs, all adopt a similar screen format which presents the game information in a very easy-to-understand fashion.



	Colour adjustability	Clocks on screen	Levels	Sound	Copy screen	Copy game	Save current game	Best move found so far	Requires pressing enter	Recommended moves for user	Technical information	
Artic SPECTRUM CHESS II			Time 1 sec to 16 hrs	●	●	●	●	●	●	●		Complicated entry procedure.
CP Software SUPER CHESS II	●		7	●					●	●	●	
CP Software SUPER CHESS			10						●	●		Can select 'tactical' or 'positional' game.
Micro Gen MASTER CHESS	●	●	10	●	●		●			●		Visually pleasing. Complicated to correct if you make a mistake. Can change level.
Quicksilva THE CHESS PLAYER			7	●	●	●	●					Sophisticated sound. Range of comments appear on screen. Can change sides or level. Can't record game after checkmate.

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cope with all these dangers so it decides to jettison its knight.

23 Rh1-d1 Qc6xf3
24 Rd1-d7 Qf3xf2+
25 Kb2-b3 Ne7-c6
26 Rd8-e8 Qf2-c2+
27 Kb3-a3

Now Black could have forced mate by 27... Qc2xc3+, 28 Bc4-b3 Qc3-c1+, 29 Ka3-a4 Qc1-c5 when White can only delay the end for a couple of moves by giving away both rooks.

27 ... Nc6-e5
28 Re8xe5 Qc2xc3+
29 Bc4-b3 f6xe5

and Black won easily with his huge material advantage.

The final game extract provides a vivid example of the 'horizon effect'.

GAME 3

White: *Spectrum Chess II,* Artic
Black: *Master Chess,* Micro Gen

1 f2-f4 d7-d5
2 Ng1-f3

Spectrum Chess II started with this unusual opening both times it had White, possibly to take the other program out of its opening 'book'.

2 ... Nb8-c6
3 Nb1-c3 Qd8-d6
4 d2-d4 Bc8-f5
5 Nc3-b5

Objectively a bad move because after Black's reply the knight has to return to c3, but in this game it turned out very well for White!

5 ... Qd6-b4+
6 Nb5-c3 Ng8-f6
7 a2-a3

Black should simply return to d6 with its queen.

7 ... Qb4-c4??
8 e2-e3

The queen is trapped in broad daylight! Too late Black sees the imminent loss of the queen but is able to push it over the 'horizon' of the program's limited search depth by giving away two pieces. Of course, after White has taken the pieces the queen is still lost, but this fact is too deep to be perceived by the program.

8 ... Bf5xc2
9 Qd1xc2 Nc6xd4

Black's effort would have been to no avail if White had continued 10 e3xd4 Qc4-c6, 11 Bf1-b5 pinning the queen against Black's king, but White missed this, took on d4 with the wrong piece and let the queen out of the trap.

10 Nf3xd4 Qc4-c5
11 b2-b4 Qc5-b6
12 Bf1-d3 0-0-0
13 0-0 g7-g6
14 Nc3-a4

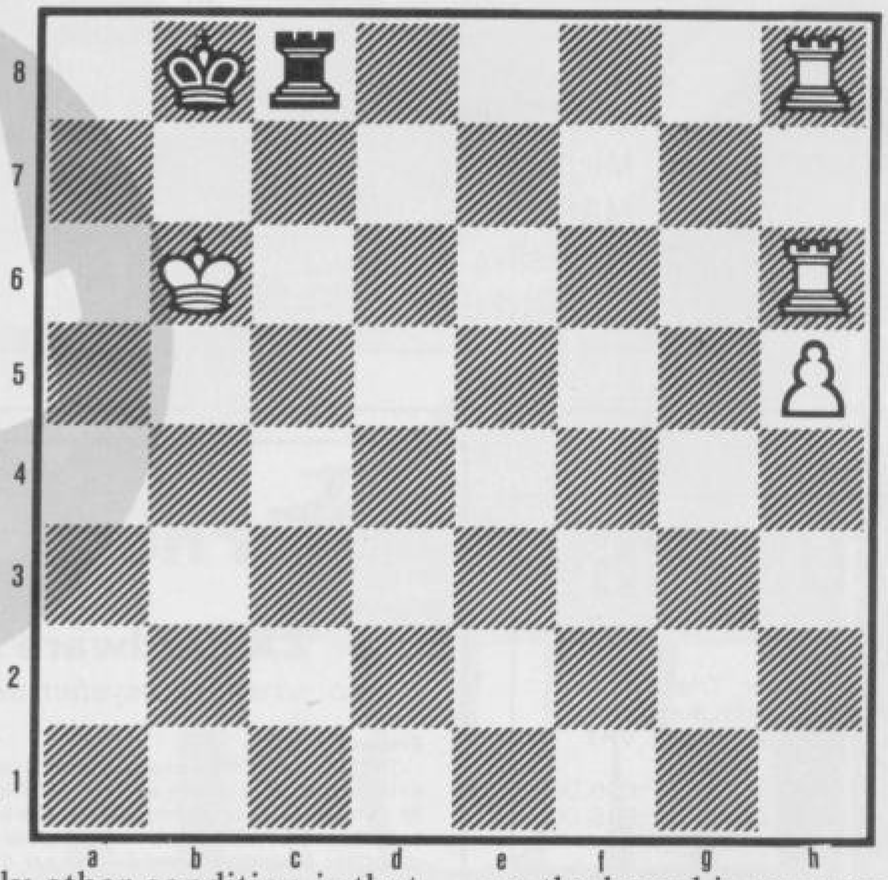
and White won with its two extra pieces.

POINTS ROUND-UP	1	2	3	4	5	Total
1 Artic SPECTRUM CHESS II		1	½	1	1	3½
2 CP Software SUPER CHESS II	0		½	1	1	2½
3 CP Software SUPER CHESS	½	½		½	½	2
4 Micro Gen MASTER CHESS	0	0	½		½	1
5 Quicksilva THE CHESS PLAYER	0	0	½	½		1

YOUR SPECTRUM CHESS COMPETITION

PROF. BRAINSTAWM'S PROGRAM CHALLENGE

The competition that's open to both chess players and virtual chess illiterates alike — a basic knowledge of the rules is all that's required.



Grand Master, Dr John Nunn, has set us the following chess problem, a classic variation of 'white to play and mate in two moves'. Only rooks, kings and a pawn appear on the board and these pieces can of course only be moved in the normal way. The only other condition is that there be no pawn capture during play. The solution is unique.

HOW TO WIN

Your Spectrum is looking for the program that solves this problem the fastest (in the event of a tie, the program with the least amount of key-strokes wins).

THE RULES

(a) entrants must have written the program themselves; (b) entrants must never have played in the PCW tournament; and (c) the programs must not be commercially available.

A rather lavish prize will be offered to the programmer who can come up with the fastest solution to this chess problem.

Obviously, with a smattering of machine code you could clean up the board in a matter of seconds but to allow more of you a chance to win, we have decided to make the competition solvable by Basic only.

Finally, please (to the best of your ability) time your program's solution to the problem and write this on the back of the envelope.

PRIZE WINNERS

The winner will receive a complete Spectrum package, consisting of 48K machine, printer, Microdrive and Interfaces One and Two. Brainstawm is indebted to *Sinclair Research Ltd* for the company's very kind donation of these prizes.

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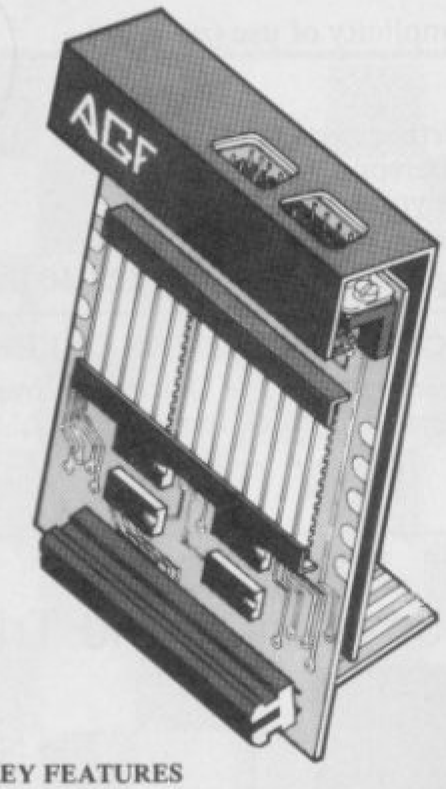
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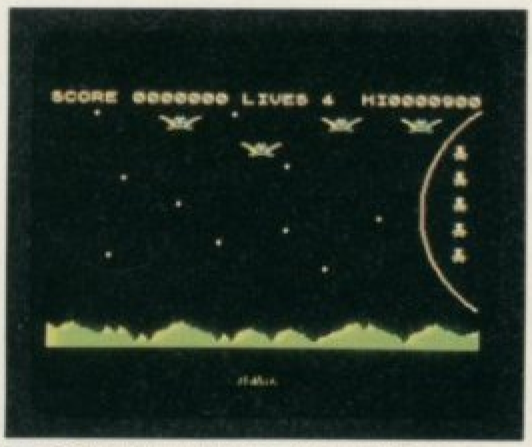
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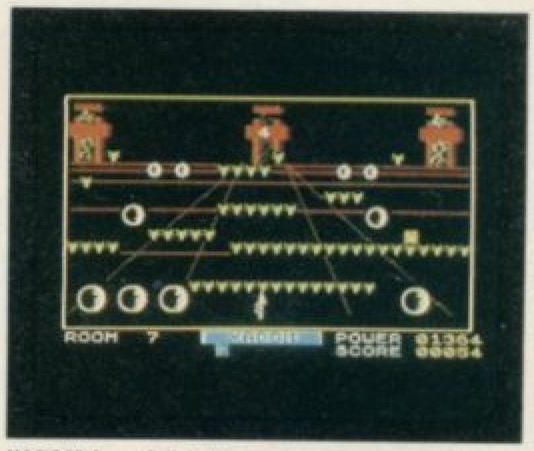
...O.K. on all issue Spectrums...

SPECTRUM SOFT

Ron Smith ***takes a slightly jaundiced look at all that's latest and greatest in games and leisure software for the Spectrum.***



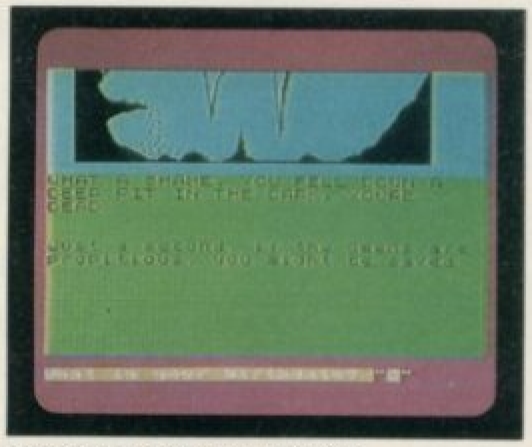
GALACTIC ABDUCTOR from Anirog Software



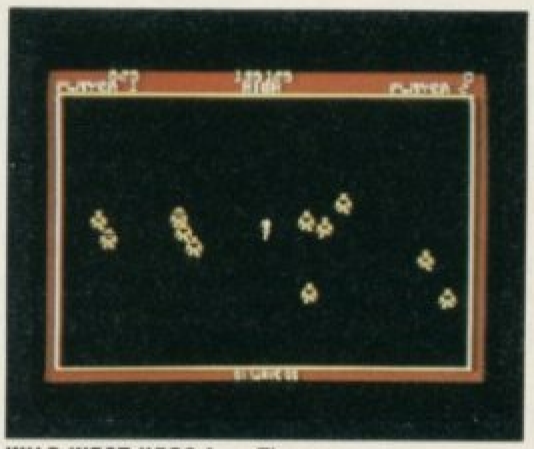
XADOM from Quicksilva



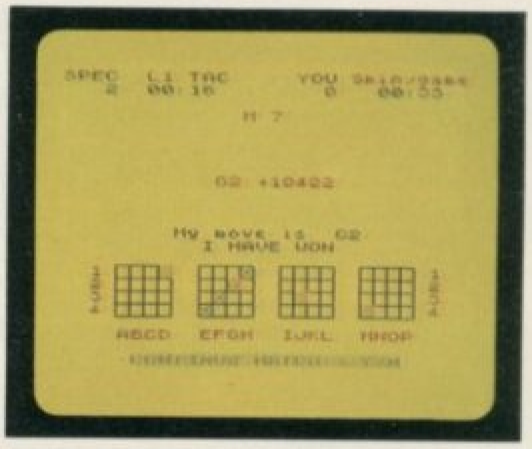
MISSILE DEFENCE from Anirog Software



SMUGGLERS COVE from Quicksilva



WILD WEST HERO from Timescape



WOODS OF WINTER from CRL

Ever since the time home computing became big business, software producers have been writhing away in ever greater paroxisms of effort in their attempts to evolve games that are innovative, complusive and exciting. Child geniuses have been dragged out of suburban housing estates and brutally hounded into the 20th Century equivalent of sweeping chimneys — all in pursuit of the computer game fast buck. The first waves to appear were, predictably, blatent copies of the great old arcade favourites — destroy the invading aliens, and probably your own brain cells in the process. This, of course, requires a keen eye and grand prix reactions. But for those without souped-up senses, the result is usually one of boredom and frustration. Fortunately, for those like me who would get more fun out of destroying the tape cassette than the alien invaders, other more pleasurable varieties of computer game are increasingly coming to hand. This issue we take a random stroll through a cross-section of all that's new and fantastic (it says in the press release) starting with . . .

THEY CAME FROM OUTER SPACE

The first title to fall into this category is *Galactic Abductor* from Anirog Software. It's not too hard to handle, and even I managed to put together a reasonable score while attempting to stem the relentless attack of invading armoured space hawks. I particularly like the fact that only three keys are used, so you don't have to keep glancing down to see where your fingers are.

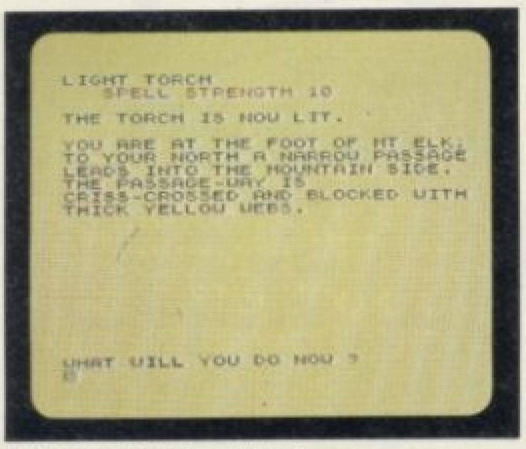
Unfortunately, one can't say the same for *Missile Defence*, also from Anirog. This uses no fewer than seven keys, four of which are the cursor control keys — which in my experience are the worst possible choice. Positioned as they are (it's rather like the old chestnut of rubbing your stomach and patting your head at the same time) everything gets out of sync and the game's over before you can shout "Nukes away". However, after a good deal of practice (assuming you have the patience) the poor old aliens who've come to attack your cities gradually begin finding themselves in a weaker and weaker position as your skill increases. No fewer than three fire buttons are provided to wipe out the monster meanies, before they either destroy you or disappear off the edge of the screen. It's all familiar stuff.

The last game doesn't fit in this section at all — but never mind. It comes from Timescape and is entitled *Wild West Hero*. Predictably, the hero's job is to rid the West of the gun-totin' bandits and this, with your help, he tries to do by hurtling around the screen blasting out in all directions as the gruesome gang closes in. Control, on the pre-production version, is via the keyboard, and uses four keys (two fingers per hand being the maximum for a reasonable response for most of us) — theoretically making for an easy-to-play game. However, the combatants are nothing if not fast moving — even though Timescape has already slowed down this (version 3) over the previous (version 2). Consequently, with bullets flying thicker than a hail storm and goodie and baddies moving at lunatic pace, this little number is certainly not one for those of slow or nervous disposition; even a rapidly plugged-in joystick did little to help me catch up with the action. For the record, by the way, the first two games mentioned were also joystick compatible.

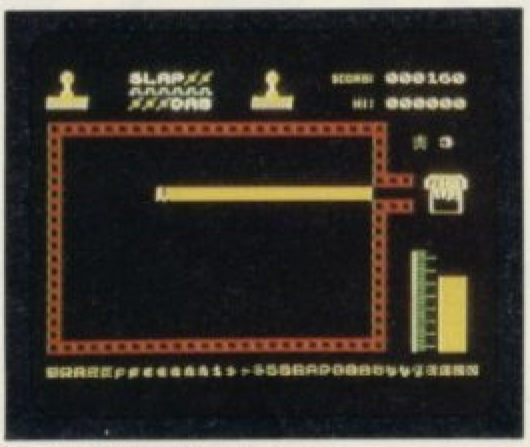
GRAPHIC ADVENTURES

'Ask a silly question, get a silly answer' — is a maxim that might well be seen as the basis for most adventure games with

their thin plots, limited vocabulary and text-only approach. Interestingly though, the latest releases are beginning to move away from this.



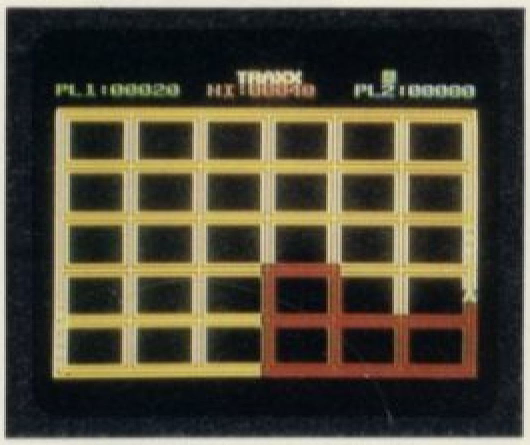
VELNOR'S LAIR from Quicksilva



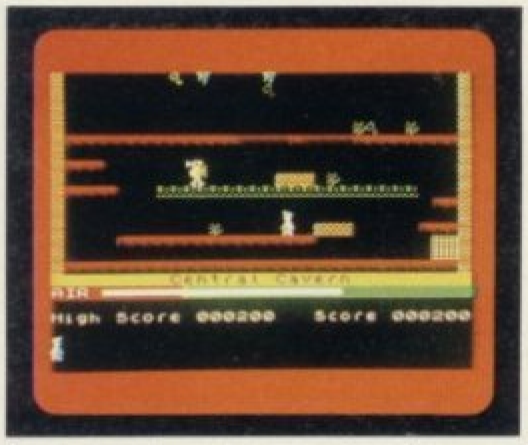
SLAP DAB from Anirog Software



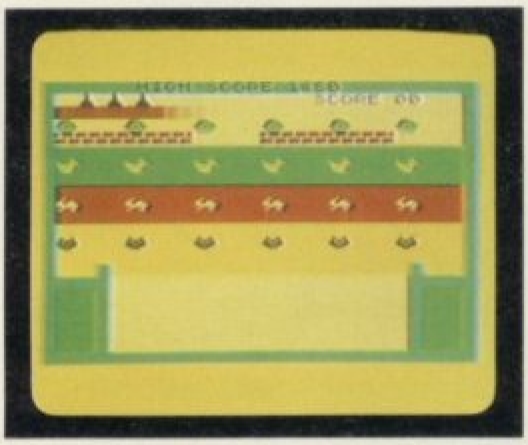
BUGABOO from Quicksilva



TRAXX from Quicksilva



MANIC MINER from Bug-Byte



QUACKERS from Rabbit Software

Two of the better new titles are *Xadom* and *Smugglers Cove*, both from Quicksilva. *Xadom* is a 3D hi-res arcade quality adventure where you, as SOL agent MM have to disappear off in search of some artefact that is stashed away in one of 20 rooms. Every time a room is entered, naturally, a new challenge awaits and each must be overcome before it is possible to move on to the next room.

Differing slightly, and more like a traditional adventure, is *Smugglers Cove*. This offers text with the delights of hi-res graphics, while you visit 27 locations, somehow or other picking up 65 objects along the way (without so much as a sack). One point here is the game's lightning response to your directions, something which many previous adventure game incarnations have been less than famous for. Both of these are well worth a spin.

CRL's *Woods of Winter*, however, is a new release that still suffers the perils of being text-only. It also has a slow response time — so much so that on several occasions I was left scratching myself and deliberating the state of the universe before — eventually — the program decided it was good manners to respond. To be fair, it does plot your progress (should you make any) through the cold woods of winter, which presumably can be quite useful at times. Should you ever manage to come in from the cold, you'll find sanctuary in a warm castle. Actually it's a good game for those with plenty of patience and an over-active imagination.

Velnor's Lair, from Quicksilva, is yet another text-only adventure, but one with a faster response time that doesn't tax the patience to quite the same degree. As an adventurer you can choose to be a wizard, warrior or priest, depending on your inclination. For no particular reason I chose to be a wizard, despite my ineptitude at casting either spells or enemies into oblivion. Naturally I soon met an untimely end. But where this game triumphs over other text-only adventures is in its use of vocabulary. Often it can take aeons to get into the swing of adventure games — understanding the individual programmer's own peculiar logic and choice of words, etc. Here, for some reason not immediately apparent, I found the game responding easily to my instructions.

Overall, the category contained an above average selection with one semi-adventure (*Xadom*), one text and graphics mixed (infinitely better in my opinion) and two giving text only. In truth, though, the big worry with all adventures is their great similarity and the obvious restriction on use of vocabulary.

FUN & GAMES

"Look at my wonderful new clothes!" boasted the emperor. Everyone remained silent except the little boy who gave the straightforward opinion that the silly fool wasn't wearing any. This showed a certain degree of naivety and lack of cynicism — just the kind of qualities you might find ideal to survive the offerings ahead.

Bugaboo (Quicksilva) features a likeable little flea (if that's not a contradiction in terms) which, due to some unfortunate time warp perhaps, has fallen through the inky spaces between worlds and ended up somewhere rather unpleasant. What will our micro nipper find there . . . will it ever survive? I had several goes at the game, reacting differently each time to it. Sometimes I felt sympathetic as the poor creature tried desperately to escape from its pursuers, sometimes an evil grin and a wicked heart triumphed as the poor fool smashed its head for the hundredth time. Love or loathing, there's always a strong feeling for the flea!

Pathos, however, is unlikely to raise its tragic head in the case of *Manic Miner* from Bug-Byte; it's more a case of frustration and panic as you guide Willy the miner through the underground caverns to the surface, and riches. Starting off in the central cavern, he has to be helped past numerous


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obstacles on his way to the next. As ever, though, it's a case of one step forward, any number back, as you master the first hazard only to fail dismally at understanding the complexity of the second.

LIFE'S LITTLE PLEASURES

There's no real reason why computer games should always be difficult; sometimes it's fun to switch to something where success comes easily — if only to restore a damaged ego.

Slap Dab from Anirog Software is just such a game, and it involves helping Sam the Painter splash around with his oversized brush so that he can get the job finished. Of course it's not quite that simple, because no sooner has he started slapping on the paint then he disturbs the woodworms — who don't fancy the idea of changing colour this week. They decide to seek revenge by chasing Sam as he works. But fortunately for him, our slimy friends can only travel on the part that's been painted, so one way of him avoiding capture is to leave by an unpainted escape route. Sounds like the stuff of which nightmares are made!

Another conceptually simple game is *Traxx*, from Quicksilva. It opens with a large yellow grid consisting of 30 squares, and in essence it's similar to the hoary old children's pencil and paper game of 'dots', where the idea is to join the points up into squares. The game starts with one side of one square coloured red, and your spaceship (what else?) in the red sector. From then on you must move around, colouring as many squares as you can. But be warned, you are being pursued, although exactly how many enemies and at what speed they chase is entirely up to you. Choosing the fastest speed with the maximum number of pursuers (nine) makes for a near impossible task, although as usual it's easier with a joystick.

Rabbit Software's *Quackers* is virtually identical to a shooting gallery at the fair. Ducks and rabbits glide across the screen so slowly that it's almost impossible to miss them, although it's almost more fun if you try. Slightly more difficult is the last part of the game where, having gunned down all the targets, you're given the chance to 'keep the turtle hopping' by shooting at it as it moves quickly across the screen. A few moments of gratuitous violence for all concerned.

Slap Dab and *Traxx* are both joystick compatible, but surprisingly, *Quackers* isn't. It does, however, let you define your own keys.

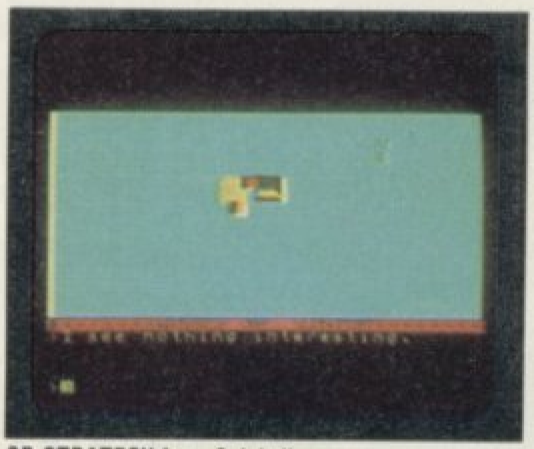
OTHER STUFF

The three titles lumped together here have little in common, other than the fact that they are somewhat unremarkable — and also rather difficult. Quicksilva's *3D Strategy* is a 3D noughts and crosses game that the maker claims is virtually unbeatable. Those into mind-bending puzzles will probably enjoy it. But away from strategy and on to games requiring fast reactions, there's *Escape MCP* from Rabbit Software and *Gridrunner* from Quicksilva. The first of these finds you de-atomized by a chip (Z80 in this case) and trapped in a maze. There's also something called the MCP (male chauvinist pig, perhaps?) that apparently knows your escape plan and, armed with this information, is not only going to prevent you from getting away, but is also hell bent on securing your prompt destruction. The usual, friendly, stuff.

A little less strange may be *Gridrunner*, although it's hard to say when there's no instructions to tell you what's going on. However, it seemed safe to assume that I'd better start destroying something before IT destroyed me. The screen is covered by a red grid, along the top of which moves a blue wormlike 'something' — presumably the enemy. It progresses across the screen, then down a line, and so on. But as each part of the 'something' is hit, it starts flapping about and moving much faster than before. Interesting — I can't wait to read the instructions!

STIMULATING SIMULATIONS

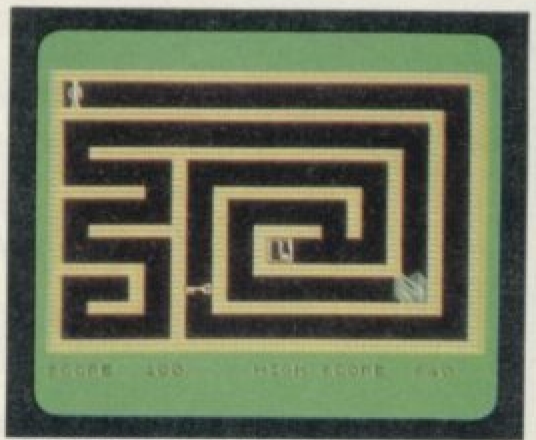
I must own up to a prediliction for the kind of games that simulate 'real life' in some way. After all, how many of us get the chance to drive a racing car, fly an



3D STRATEGY from Quicksilva



CHEQUERED FLAG from Psion



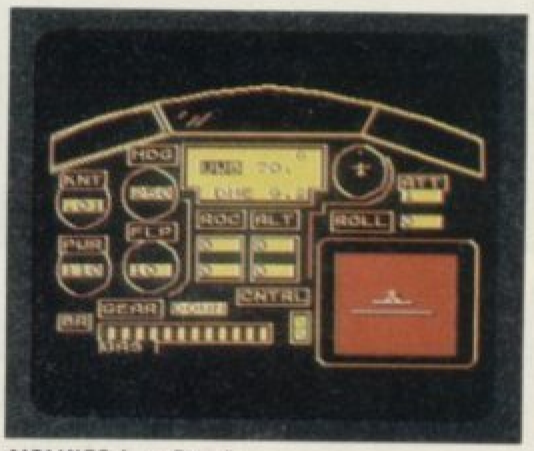
ESCAPE MCP from Rabbit Software



RACE FUN from Rabbit Software



GRIDRUNNER from Quicksilva



AIRLINER from Protek

airliner, or practise being a brain surgeon? Well, courtesy of Psion, Rabbit Software and Protek Computing, we can indulge in renewed fantasy, over the first two at least.

First of all from Psion comes *Chequered Flag* — a game that will find you lapping away on some of the world's most famous motor racing circuits — from the relative safety of your own living room. It also features a choice of three cars, and for those who feel a little uneasy about gear changing, an automatic has been included. Intrepid participants will have to watch the dashboard instruments carefully to make sure they're not going too fast, running out of fuel, overheating, or about to encounter any of the other hazards involved in grand prix racing. As well as watching out for mechanical failure you'll need to keep an eye out for oil, water and glass, any one of which is likely to lure you into untimely disaster. But the most impressive feature of *Chequered Flag* is the view from the car as you hurtle like a maniac around the track.

Still behind the wheel, but not this time a simulation, is *Race Fun* from Rabbit Software. It's your chance to prove what a crazy driver you are, by speeding down a narrow country lane at 120 mph. The faster you drive, the more points you'll make, but of course the more chance there is of crashing.

Airliner, from Protek Computing, is a realistic simulation of what it's like flying a commercial aircraft. All the normal controls are present, enabling you to take off, manoeuvre, navigate and land; it's also compatible with Protek's joystick, which does add to the fun. Flying the plane successfully requires a good amount of practice — in fact I wouldn't be surprised if it was almost as complex as the real thing. A map is included to show the aircraft's position, and this can be turned on or off at the touch of a key. It's a well written and sophisticated program, but the lack of a view from the cockpit is disappointing, especially when you consider the popular *Flight Simulation* from Psion. However, Protek's program fits into 16K, while Psion's needs 48K.

WE LOOKED AT . . .

Galactic Abductor (16/48K), Anirog Software, £5.95
Missile Defence (16/48K), Anirog Software, £5.95
Wild West Hero (48K), Timescape, £5.90
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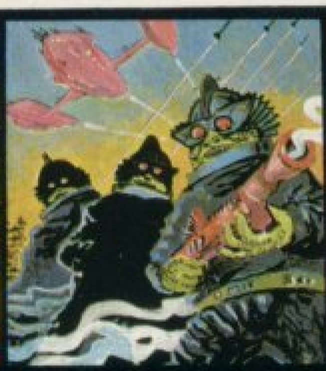

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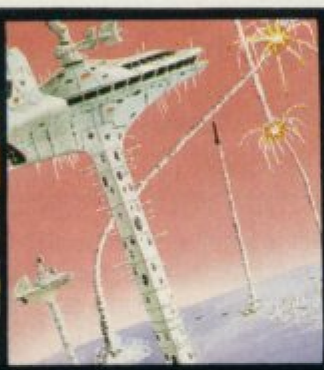
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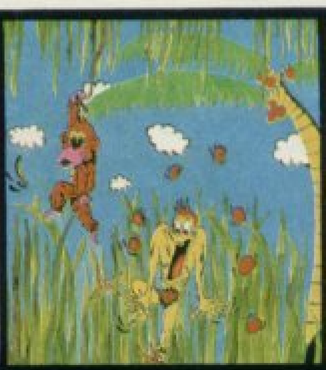
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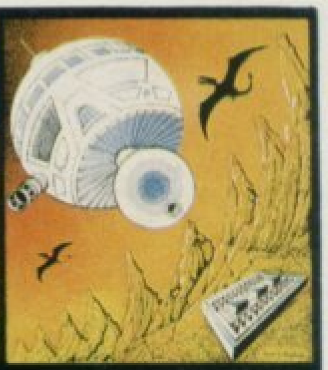
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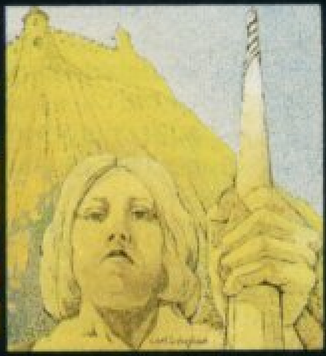
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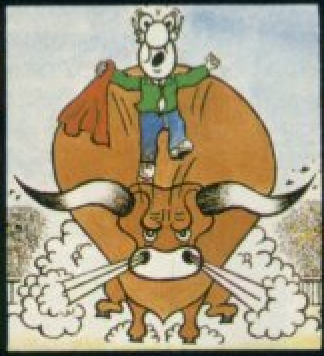
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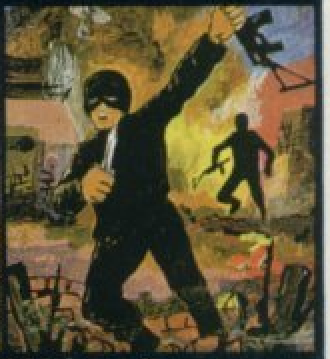
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DIY SPECTRUM KEYBOARD BUFFER

Frigging with the rigging is not as difficult as you might at first think. Stephen Adams gives comprehensive instructions on linking the Spectrum to an alternative keyboard, via its rear expansion port.

Most people who want to modify and improve their Spectrum look first at the keyboard as a prime area for change. But straightforward replacement involves digging around inside the computer — something of a put-off, for two important reasons.

To begin with it might nullify the guarantee from Sinclair and, frankly, there's just no-one else around to undertake this kind of repair work (there's no published circuit diagram and a lack of certain specialised parts). Secondly, it's easy for damage to occur when fitting the keyboard to the computer or mounting the keyboard in a separate case (which requires the removal of the complete circuit board from the casing of the computer).

So what's outlined here is a keyboard buffer that fits on the back of the ZX Spectrum, connecting to the real expansion port. It can easily be fitted or unplugged for testing, and should your Spectrum develop a fault, it can be removed without trace for guarantee purposes.

KEYBOARD: FUNCTION & DESIGN

The Sinclair keyboard, like many others, works on a matrix of keys where each key connects up two wires. The combination of the incoming and outgoing wires is continually being tested by the computer to see which one has been pressed. On the ZX Spectrum the keyboard has eight incoming wires — the upper eight address lines. These are tested by holding only one of them to a Binary 0 (a LOW signal) and seeing what the result is on the incoming (data) lines. If a switch has been pressed on the address line being tested, then the LOW signal will be passed on to the data line to which it is connected. Until then the data line will be held to a Binary 1 by the resistors connected to the five data lines.

In the keyboard layout diagram (Figure 1) the keys as you can see are arranged in a similar order to the keyboard (but not in the familiar QWERTY layout). The five data line connections are shown at the top and the address lines at the sides. There is only one address line and one data line combination that can be produced by each key. The 'A' key, for instance, will operate only when the A9 address line is tested and will pass on the signal to the D0 data line if pressed.

The 'scanning' of the keyboard (as it is called) is done by use of an IN A(C) instruction in machine code which lowers the address lines in turn, starting with A8 and progressing to A15, checking for a keypress on the data lines as it does so. It uses the B and C registers inside the Z-80A to give the 16-bit address (which is put out on the address lines A0 to A15). This is done every 1/50th of a second using the timer within the ULA to trigger an INTERRUPT instruction to the Z-80A microprocessor.

The keyboard port is referred to as FE in hexadecimal notation or 254 in decimal, but operates as long as the A0 address line is a LOW signal (Binary 1). The electronics for the port is located within the ULA, and the data lines must be connected through the ULA to the microprocessor only when the correct address is detected. Connecting them straight to the data lines of the Z-80A would cause utter confusion as both the address and data lines are used for other devices as well, like the RAM.

DECODING THE KEYBOARD PORT

The keyboard buffer's port must operate in the same way as that of the ZX Spectrum in order to work properly — but with modifications such that the keyboard connected to the buffer will override the internal keyboard.

The ULA only uses three lines to tell it when the keyboard port should operate and we shall do the same. The IORQ line determines that it is an IN or an OUT instruction, the RD line that it is a READ instruction into the Z-8CA and the AC address line that it is the correct address. Only when all of these are Binary 1 (LOW) is the address correct, and the data lines from the keyboard connected to the Z-8CA. As these are all correct when they are LOW, we can use a device called a NOR gate to detect this. On our three input NOR gates (part of the 74LS27) only when all three inputs are LOW will the output change to Binary 1 (HIGH). See the circuit diagram (Figure 2).

As the buffer chips we are using (the 74LS245s) operate on a LOW signal we need to change this HIGH signal from the first gate into a LOW signal.

DATA LINES Figure 1. An illustration of the Spectrum's keyboard layout.

	D0	D1	D2	D3	D4	D4	D3	D2	D1	D0	
A11	1	2	3	4	5	6	7	8	9	0	A12
A10	Q	W	E	R	T	Y	U	I	O	P	A13
A9	A	S	D	F	G	H	J	K	L	ENTER	A14
A8	CAP SHIFT	Z	X	C	V	B	N	M	SYMBOL SHIFT	SPACE BREAK	A15

We use the second NOR gate in the chip to do this. As all the inputs to the second gate are HIGH when the address is correct and all LOW at any other time (the NOR gate always reverts to a LOW output) the output will be LOW when the address is correct.

This LOW signal is used to operate a buffer which just appears to be transparent to the data lines when the OE line (pin 19) is LOW. When it is HIGH the outputs are disconnected and have no effect on the microprocessor. This is called a high impedence or *tristate* buffer as it can present three conditions, high impedence (disconnected in simplicity), Binary 1 or Binary 0 (from the inputs). If nothing is connected to the inputs (ie. no switch has been pressed) the internal resistors of the chip set the inputs (and thus the outputs if the OE line is LOW) to Binary 1, just like the Sinclair keyboard).

The data lines from the 74LS245 are connected to the data lines via 1.5K ohm resistors to enable you to use the existing keyboard as well as the new one. This is an option that can be cancelled by installing wire straps instead of resistors. These were left in as a further development of this board is to use it to connect up Atari type joysticks to the Sinclair and people may still want to use the buffer board only for the joysticks.

The other 74LS245 chip is permanently operated in its WRITE mode (ie. towards the IC socket) by connecting pin 1 to the +5 volt line. The OE pin is also connected to the 0 volt line making its outputs always available. Thus any changes on the upper eight address lines appear on the pins 1 to 8 of the IC socket.

The data line buffer chip is always in its READ mode by connecting it to the 0 volt line.

The keyboard is not being described as the user can build his or her own from keyswitches bought as part of a kit (such as those from Maplin or Ambit) or purchased on their own. Alternatively, a keyboard can be bought from many ZX suppliers both with and without a case to plug into the keyboard sockets. In this case you can plug it into the IC socket when it has been modified.

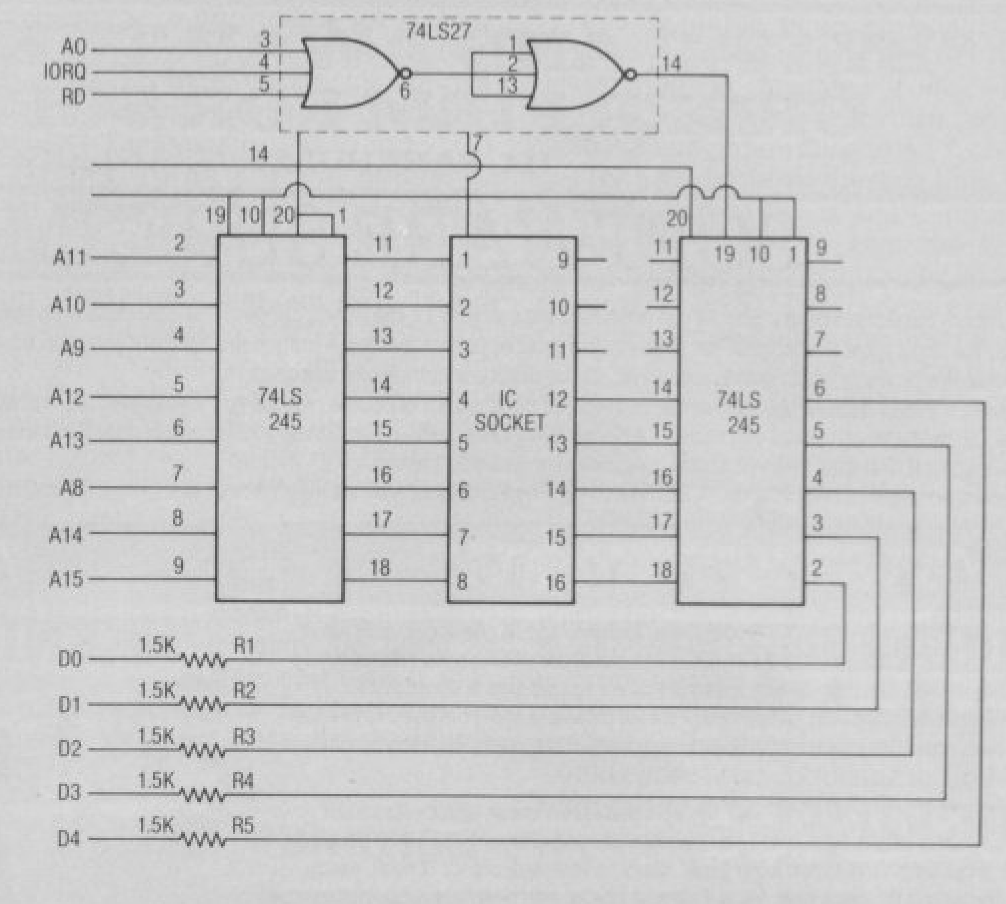


Figure 2. The circuit diagram of the Spectrum's keyboard buffer.

MODIFYING THE IC SOCKET

It's very difficult (if not impossible) to buy a socket of the type used on the Sinclair Research computers. This consists of an eight and a five holed in-line socket which uses metal flaps to trap the very thin, metal covered, mylar strips that make up the keyboard connections.

A particular type of IC socket, however, uses a similar arrangement to hold in the IC. This is called the Zetronics socket and a 16-pin type is required. They are blue in colour and the two, white metal strips can be clearly seen on both sides of the pin holder. They can be obtained from Maplin, Ambit and others.

The only modification that needs to be done is to use a sharp craft-type knife to cut away the plastic separations between each of the IC pin holders. This you do by slicing the socket on the top along the gap between the two metal strips on each side of the holder that makes up the pin holders. Once this is cleared away the strip can be pushed all the way into the socket, the data lines at the top and the address lines at the bottom. The address lines are the wider of the two strips.

CONSTRUCTING THE BOARD

The first step is to insert the ICs and the edge connector temporarily into the board to give an idea of where the straps go. These should *not* be soldered in at this time. The veroboard design has been numbered and lettered to make it easy to identify the holes (see Figure 3).

Only one awkward strap exists which is the one connecting A0 to the 741S27 IC pin 3. This must be taken through the hole in the 'legs' of the edge connector below where the keyway is.

All of the ICs go the same way round (including the IC socket) with the cutout or dot on the left-hand side. Thus pin 1 should always be the first pin on the bottom left-hand side and the last pin (14, 16 or 20) on the top left-hand side. Great care has been taken to check the straps shown, the bare wires are indicated by single lines and the insulated straps by fatter ones. The strap from AF9 to AF12 goes over, but does not touch, the strap below it (which goes from AA10 to AG10). The strap from B1 to E1 does the same.

All straps should be inserted *before* the ICs are soldered in and the tracks on the opposite side of the board should be cut only *after* the straps have been done. This means that any mistakes can be checked for, before any irreversible cutting has taken place.

Once the straps and resistors (if required) have been put in, the ICs can be inserted and soldered. The edge connector should be fitted last and should have small sleeves inserted over the last leg at each end to hold it 0.3inches away from the veroboard. These can be made out of small pieces of insulation stripped from the straps. This is to allow room between the board and the case of the ZX Spectrum which is left untouched.

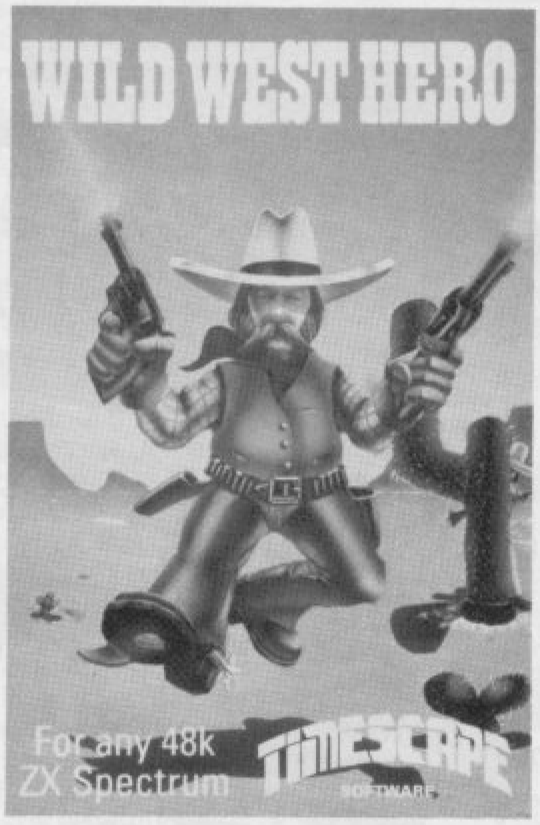
A printed circuit board edge can be fitted at the back, soldered to the pins of the edge connector. This would need to be 28 strips of 0.1 inch spaced board with a keyway cut at pin 5. These can be purchased from Haven Hardware, Timedata and other ZX hardware suppliers. The edge connectors can be obtained from your author.

TESTING

Before the board is connected to the ZX Spectrum, check that there is no direct connection between the +5 volt line and the 0 volt line. These, and all the other connections to the ZX Spectrum, can be found on page 180 of the Basic programming manual. For some unknown reason the top connections are at the bottom and the bottom connections, at the top. The only way to check these connections is to turn the book upside down, then you'll get the image of the connections at the back of the computer! The IOROGE should not be used instead of the IROQ.

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The board should be connected to the computer with the power off, the power then being turned on by plugging-in the jack plug at the back of the computer. The plug should be immediately removed if the screen does not show the copyright message after clearing the screen. If this does happen then try connecting up a data line and an address line on the IC socket (it can do no harm). This should simulate a keypress and the screen should show the key pressed. If held on for more than a second it should repeat. Neither of the SHIFT keys will do this, so try another key.

If this did not happen, then check all the connections again — if you get coloured squares on the screen it could be that the data IC is permanently operated, so check the connections to pin 19 and the 74LS27. Also check that the address or data lines are not accidentally connected together. Complete failure of any picture would seem to suggest a power fault of some kind, so check the +5 volt and 0 volt lines.

If you get the Sinclair Research copyright sign, but none of the combinations work, try using the keyboard. If you have not put the resistors in, but used straps instead, then this should be inoperative, showing that the data buffer IC is being operated correctly. Then check the address lines. A temporary solution when checking address lines that do not work is to solder a piece of wire on to one of the data lines (to the IC socket) and touch that directly on to the edge connector (for that address line). This should operate the key.

Once the connections to the IC socket have been checked and operate as they should, the keyboard can be connected. If you are building your own it might be worth investing in a '16-pin DIL header' to make the connections to the IC socket (in which case the modifications to the IC socket are unnecessary).

Components

2 74LS245	£2.20
1 74LS27	£0.20
1 Zetronic IC socket	£0.20
5 Resistors 1.5K ohms (optional — see text)	£0.15
1 piece of veroboard — 4¾ by 3½ inches	
1 ZX Spectrum 0.1 28-way edge connector	£2.25
1 Printed circuit board edge 28-way 0.1 inch spacing	£1.10
Insulated wire and bare wire for straps	

HARDWARE SOURCES

Maplins Electronic Supplies Ltd, PO Box 3 Rayleigh, Essex SS6 8lR. Tel: 0702 552911

Ambit International, 200 North Service Road, Brentwood, Essex CM14 4SG. Tel: 0277 230909

Timedata, 16 Hemmels, Laindon, Essex SS15 6ED. Tel: 0268 418121

Stephen Adams, 1 Leswin Road, London N16 7NL. Tel: 01-254 1869

Haven Hardware, 85 Scotch Street, Whitehaven, Cumbria. Tel: 0946 66586

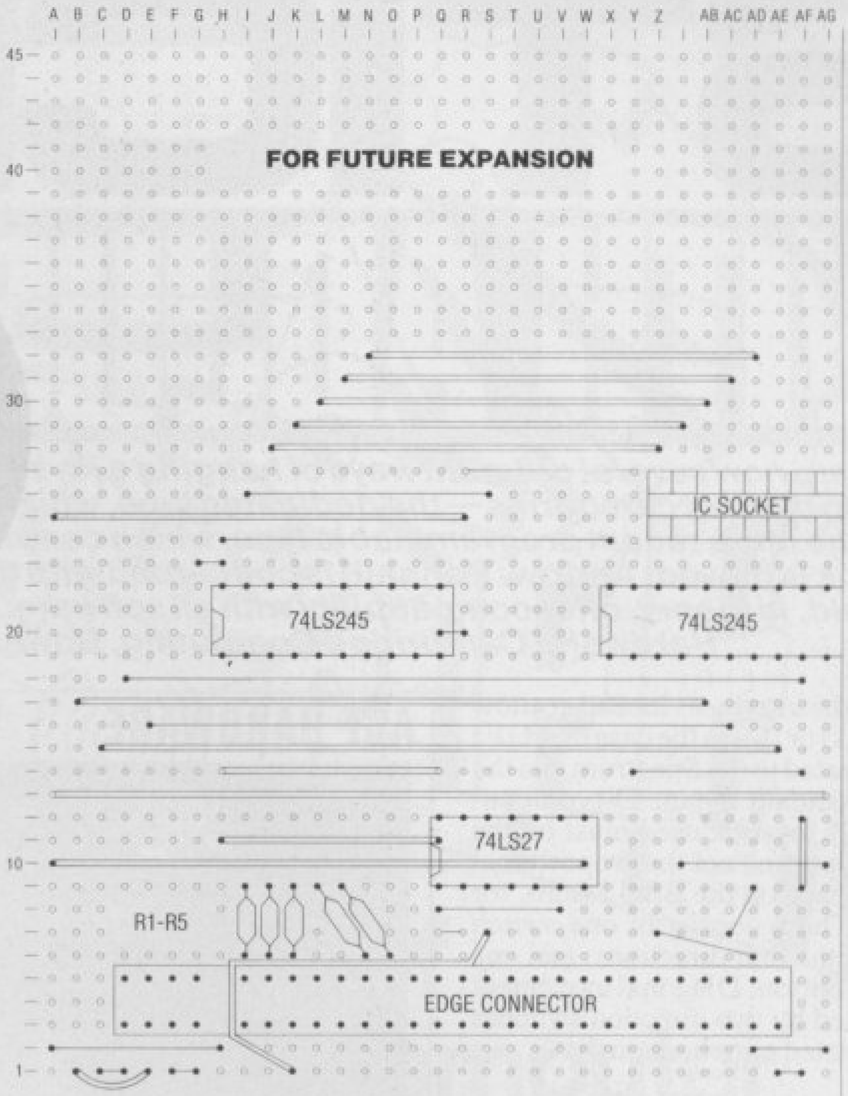
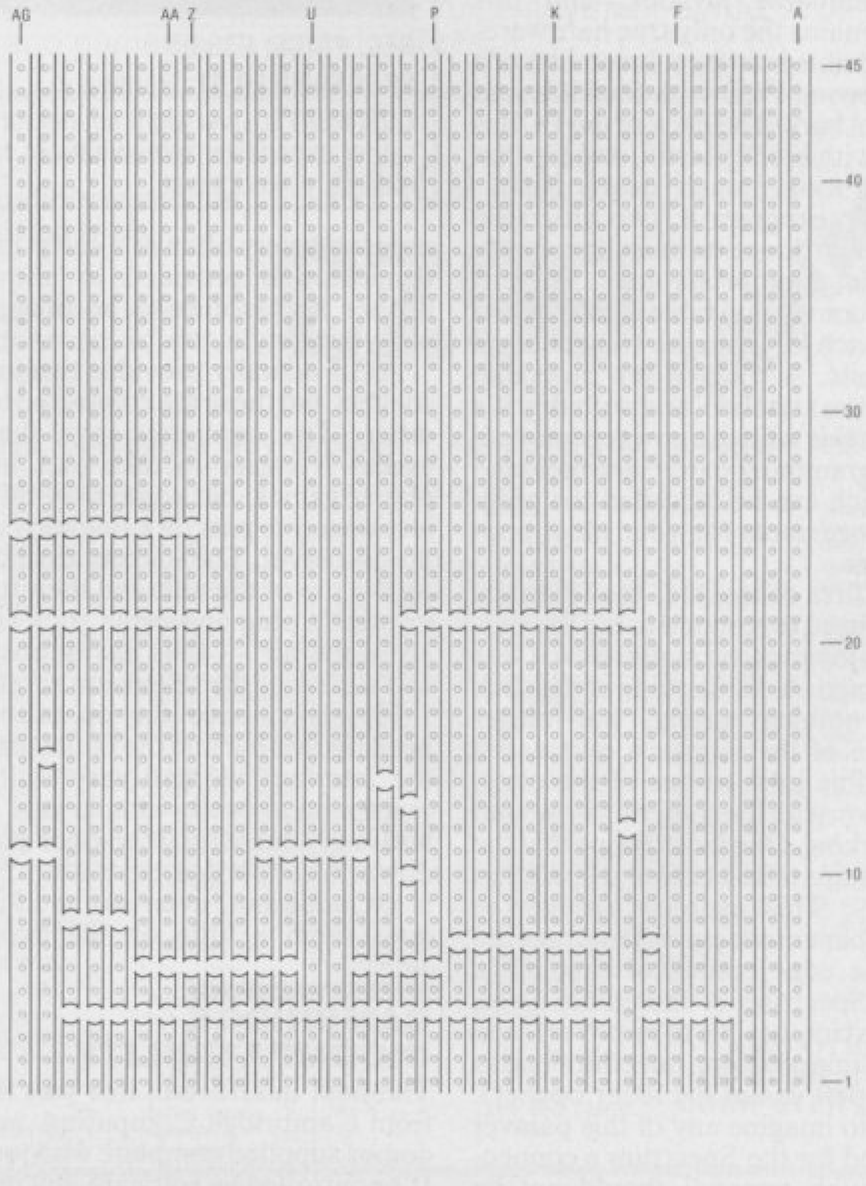


Figure 3. The top illustration shows the component side of the veroboard. The strip side of the keyboard buffer is shown below. The veroboard has been numbered and lettered to help you identify where the components go.



STICKING WITH ADJUSTABLES

There are now several different ways of hanging a joystick on to the Spectrum, and they fall into two distinct categories — the dedicated type, which uses fixed input/output locations, and the more recent programmable type, which can simulate any chosen keys when the joystick is moved.* Andrew Pennell, *is concerned with the second variety — devices which should, in theory, offer compatibility with all software. He examines products from AGF Hardware, Cambridge Computing, Downsway and Stonechip.

All four of the interfaces looked at allow one joystick (or two in the case of AGF) to be connected to the Spectrum, via the industry standard 9-pin, D-type connector. Any joystick used must be the switched type, and not the proportional variety as used on the BBC Micro, for example. These consist of one switch for each of the four directions, and one for the fire button. Diagonal movement is recognised by two direction switches being activated simultaneously.

AGF HARDWARE SOLUTION

AGF was the first company to produce a programmable joystick, and this device remains the only true hardware-programmable interface. It consists of a large, exposed PCB with four ICs and 13 vertical bars. The back of the PCB is covered with black plastic, and for that reason it looks much neater from behind! To program it, two crocodile clips for each direction must be connected to the appropriate bars. A self-adhesive conversion table is supplied to convert each key into the two required connections. A total of ten crocodile clips must be attached, and probably it's best to do this with the power removed. Ten 'programming cards' are included on to which can be recorded the plugging arrangements for your most popular games.

When first connected, the interface firmly refused to respond to the fire button on the joystick, no matter how it was programmed. A dismantling of the stick showed nothing wrong, but closer inspection of the interface revealed a truly terrible joint to one of the clips. Swift action with the soldering iron soon had it working. One would hope that the interfaces are tested before dispatch to customers. This exercise brought to light another unredeeming feature of the unit —the edge connector that plugs into the Spectrum is incredibly tight, and almost impossible to remove (faced with the same problem, our editor had to resort to deft use of his letter opener). It's hard to imagine any of this palaver being good for the Spectrum's connector, although removal should not be necessary very often as a carry-through connector is provided to allow any further accessories to be plugged in, piggyback style.

> **AGF HARDWARE**
>
> 
>
>
> **REC. PRICE:** £33.95
> **PROGRAMMED BY:** Hardware
> **COMMENTS:** Over-tight connector, rather expensive, somewhat unsightly, works well.

AGF actually provides two joystick sockets, but these are connected to each other. The company says that this makes it easier to take part in two-player games, but some may think it's just as easy to pass on a single joystick to the co-player. The sockets are mounted on the top of the unit and therefore the joystick's plug and cable stick straight up in the air — thus easily obscuring one's view of the television screen.

However, once the operation had been figured out and the fault corrected, the interface worked very well. Programming is pretty simple and quick, and is of course retained once power is down. A simple demonstration cassette is included but, even so, at £33.95 it does seem a little on the expensive side.

CAMBRIDGE INCOMPATIBILITY

The next interface in line was the one from Cambridge Computing, and this comes supplied complete with joystick. It's controlled by software, but requires a program to be loaded from tape first. In fact the program allows a library of data for each game to be stored on the reverse side, so each key pattern has only to be entered once. This does mean though that the tape must be run before play can begin. During the first programming sequence a problem soon became apparent — the whole machine 'hung' with the word 'OK' on the screen. It wouldn't even Break, so all that was left was to pull the plug out. Only after running through this loop again did the truth strike — your reviewer is one of the few to possess both a ZX Interface 1 and a Microdrive, and the Cambridge port uses one of the Microdrive I/O locations. Cambridge really has no excuse for this blunder, the Microdrive ports having been documented since the day the Spectrum was launched — take a look at page 160 of the manual, guys!

Interface 1 was removed for the rest of the test and that obviously means that the Cambridge interface will not work with any games that load from Microdrive. Once programmed, however, the joystick interface worked well, with either a normal stick connected, or with Cambridge's own. The latter has a second and independant fire button, which can be programmed to simulate a different key to the first. However, the only game to come to mind that needs two fire buttons is *Penetrator.*

To test the device thoroughly it was used on one of the toughest games for any joystick — *Jetpac* by Ultimate (your reviewer's normal rig being the Kempston non-programmable interface plus Competition-Pro joystick). Opinions on joysticks are very personal things, and one man's loathing is another man's love. However (to digress a little from interfaces) after playing with the Cambridge stick for some time it seemed to me the device somehow failed to make the grade. It's noisy and not very sensitive and the two fire buttons are quite small (in fact it seemed best to program them both to the same key). The shape of the case looks as if it is designed to be held in one hand and operated with the other, but cramp



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Bourne — J. H. Wand
Holbeach — Holbeach Music
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WILTS.
Andover — Peter Parks Andover Radio

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Driffield — Dixons
Scarborough — Dixons
Selby — Studio Two
Wetherby — Horton and Hollender

S. YORKS
Barnsley — Greens Telecom
Sheffield — Just Micro; Cork & Green

W. YORKS
Bradford — Empire Electro Centres
Halifax — Woods
Huddersfield — Townsend Computers
Leeds — Micro-Sell Computer Systems; R.S.C.
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CAMBRIDGE COMPUTING



REC. PRICE: £24.00 (£29.90 with joystick)

PROGRAMMED BY: Software

COMMENTS: Cannot be used with Microdrive connected, must load tape before use, reasonably priced, works well.

set in after a while and the only resort seemed to be to rest it on a table instead.

The Cambridge interface does have a carry-through edge connector, but if it is incompatible with the Microdrive it is possibly incompatible with most other add-ons too. That aside, it works well, the only hangup being the tape that needs to be loaded before use. It comes reasonably priced at £24.00 for the interface only, or £29.90 if the joystick is bought as well.

DOWNSWAY-IN REAL TIME

The Downsway unit is programmed in a very different way to the previous two —namely in 'real time'. There is a 2-way switch on the back of the unit, which is normally in the 'up' position for program mode. To program it, the memory in the interface must first be cleared — which is achieved quite simply by moving the stick to all its positions in turn, and pressing fire each time. This done, each of the eight positions may be programmed by the holding down of the relevant keys and the moving of the joystick to the required positions, each time letting it return to the centre position. The instructions say that the diagonals should be programmed first, but it seemed to me that any order would do, provided the fire button is left until last. A total of nine positions are required, and the diagonals in particular can demand a lot of finger dexterity as you press two keys with one hand and hold the stick exactly diagonal with the other.

Once programmed and switched back into the play mode, you're ready to start. However, one great advantage with the device is that the interface can continue to be programmed after a game has been loaded, and therefore any mistakes can be corrected as you go along.

The Downsway interface is easy to use, quick to program and also the cheapest, at £22.95. My only quibble is that there should be an indicator label near the programming switch.

STONECHIP DEXTERITY

The final interface to come under scrutiny, by Stonechip, at first glance seems very similar to the Downsway one. It's programmed in the same way, the only apparent difference being that there is a 3-way switch — selecting normal, program or play modes. However, in use it proved to be rather different to the Downsway device. When in program mode, the Spectrum behaves strangely. It makes unusual buzzing sounds, and the border flashes. But the sequence of operations to program it remains the same, although with the one important difference — twice as many operations are required, as the joystick has to have all eight positions programmed once with the fire button pressed and again with it released. As well as taking some time, the task proved not an easy one. To program each diagonal with fire held down requires three keys to be pressed with one hand while the other holds the stick diagonal *and* presses the fire button. And now, with my teeth. . .

As with the Downsway unit it can be re-programmed after a game has been loaded, to correct any errors — a useful facility. Once all is ready the unit must be switched to the play mode for the joystick to be able simulate the keys. But this in itself presents problems for now you will notice that no keys on the keyboard work, and the ear socket is disabled. That means programs will not load and the switch has to be continually flicked back in order to re-enable the keyboard and thus allow the choosing of options from menus.

The Stonechip interface seems to offer similar facilities to the Downsway one, but with several disadvantages to weigh against it. It's also more expensive, at £24.95.

DOWNSWAY ELECTRONICS



REC. PRICE: £22.95

PROGRAMMED IN: Real-time

COMMENTS: Can be re-programmed with game in progress, easy to use and quick to program, very reasonably priced.

STONECHIP ELECTRONICS



REC. PRICE: £24.95

PROGRAMMED IN: Real-time

COMMENTS: Affects Spectrum audio and video outputs, complex sequence of programming, can be re-programmed with game in progress, reasonably priced.

MODUS OPERANDI

How do they all work? Well, the Spectrum keyboard is based on an eight by five matrix, and was designed to be as simple as possible to read electronically. The AGF interface duplicates the matrix, but instead of having keys on it you can connect each directional switch at a particular point to simulate any key. This is electronically quite easy, but difficult to manufacture because of the matrix connections. The other interfaces are all basically similar to one another, showing just minor differences. They each contain 1K of RAM, not (as normal) in the memory map but in fact in the keyboard I/O space. This enables them to be programmed, ie. have the RAM written to, and then simulate the keys when they are read.

The actual method of switching between modes differs widely between the three. Cambridge uses another I/O port as a switch whereas the others just use a switch. The Stonechip design only has three ICs, excluding the RAM chips, but one can't help feeling that too many features have been cut to reduce the chip count.

TAKE YOUR PICK

In conclusion, it's worth the potential purchaser first deciding whether a cheaper, dedicated interface will suffice. There are three main types, produced by Kempston, Sinclair and AGF. If it will not, then choose the method you wish to use to program it — hardware, software or real-time. My personal view is that the Downsway unit takes the chequered flag, being cheapest and most easy to use. However, the AGF interface may be worth the extra expense for those preferring something that's hardware programmed — even if, as in this case, the result is a little unsightly.

IAN McKINNELL

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– SOFT, Sept 83

"I found Dungeon exceedingly well planned and written, with a fast response. There are well over 200 locations and the descriptions are both lengthy and interesting. The objects number about 100. It could therefore take some months to explore the whole network, giving many hours of enjoyment in the process."

– C&VG, Sept 83

"The descriptions are so good that few players could fail to be ensnared by the realism of the mythical worlds where they are the hero or heroine . . . great fun to play."

–Which Micro?, Aug 83

"My appetite has been whetted and I intend to get my own copy (of Snowball) to play."

– What Micro?, Dec 83



ADVENTURE REVIEWS

"This has to be the bargain of the year. If adventures are your game then this (Colossal Adventure) is your adventure."

– HCW, 5 Sept 83

"Colossal Adventure is simply superb. Anyone who wishes to use adventures in an educational setting really must use and see this program as it emulates Crowther and Wood's masterpiece so well. For those who wish to move onto another adventure of similar high quality, Dungeon Adventure is to be recommended. With more than 200 locations, 700 messages and 100 objects it will tease and delight!"

– Educational Computing, Nov 83

Colossal Adventure is included in Practical Computing's Top 10 games choice: "Poetic, moving and tough as hell."

– PC, Dec 83

"To sum up, Adventure Quest is a wonderful program, fast, exciting and challenging. If you like adventures then this one is for you"

– NILUG # 1.3

"Colossal Adventure . . For once here's a program that lives up to its name . . a masterful feat. Thoroughly recommended"

– Computer Choice, Dec 83

"wholly admirable"

– Your Computer, Sept 83

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Dept **L** 229 Hughenden Road, High Wycombe, Bucks HP13 5PG

Please describe your Computer

BROADENING YOUR COMMUNICATIONS SPECTRUM

***Communication is a two way process. If you want to communicate through your Spectrum you'll have to find out how it 'talks' to the outside world — a world made up of local (in-house) communication and distant (tele) communication. Over to* John McNulty.**

If you want to take the 'easy' way out and run the risk of ripoffs, then ignore this article. If you really want to 'know' then you'll need to put in a little effort to get a great deal out — communications people have generated jargon which is daunting. Newcomers try to fake their way through, so terms become degenerate and no one knows for certain what someone means when they use a 'standard' name for an interface or a device. There's no quick way round this primary communications problem. I can offer you a guide — the Datacomms mini-Bible — but you'll still have to work at it if you want to succeed in communications.

IN-HOUSE COMMUNICATIONS

This is the land of LANs (local area networks), line drivers and base band modems. The simplest link is point-to-point, and anything else — tree and branch, ring or star —is much more complicated. One thing is certain, the cost of installing the cabling (not the cost of the cable itself) is high. Another problem is interference — any kind of wire is acting as an aerial and will pick up all sorts of rubbish you never asked for (screened cable is a partial answer). Finally, you can bet on McNulty's 5th Law of Communications: 'The more complex the net, the greater the probability of an extremely simple result — zero'.

TELECOMMUNICATIONS OUTLINE

Those of you who now wish to boldly split infinitives and tele-trek out amongst the networks definitely need McNulty's 'Glitch-Hiders Guide to the Galaxy'. But beware the bit-battering BT Beastie, with more heads than arms. At the far end of the tele universe are rare delights, treasure houses of information, the fabled electronic mail, new friends and Richard (Micronet) Hease. Between you and those riches is a living, twitching nervous system.

When you pick up your phone, thousands of robots dance to your digit's bidding. The swift swirl of your finger will send them scurrying, sometimes falling over in their enthusiasm, to connect you to the number of your choice. It's a noisy voice network and it's a tribute to the power of the human brain that you are able to understand the degraded voice signal which reaches your ear. Your computer isn't as bright as you and doesn't have a 'voice'. To give it a 'voice' which will carry, you have to give it a translator which converts bits into whistles and back again. This device is known as a *mo*dulator/*dem*odulator — or modem. Modems have to conform to certain standards (CCITT and BT) and have to have a standard data interface. The interface into which you poke your signals and from which you get them out again is known by most as the RS232 — or CCITT V24 (more of which later).

McNulty's 5th Law of Communications:

"The more complex the net, the greater the probability of an extremely simple result — zero."

There is another interface and that's the connection to the telephone line. The PO monopoly hasn't really gone away yet and there are still stringent regulations about what you can connect and how. There are two methods of connection: by *direct connect* — just plugging straight into the phone; and *acoustic coupling* — sending the whistles into the mouth-piece and picking out the returning whistles with a little microphone stuck to the earpiece. You still need BT approval for this — in case your computer says "Boo" and frightens Buzby. Acoustic coupling is 'kludgy' and capricious. The telephone transmitter (microphone to you, sack of coal to me — no, I'm not kidding) distorts the signal. The returning signal is mixed with local noise which your microphone picks up — it's marginally better than a forked stick. The only good thing about acoustic coupling is that you don't have to worry about how to connect (unless you come across a funny phone).

Direct connect is far superior. Not only is your data cleaner but you can run faster, and more important, you can start to do clever tricks like automatic answering and dialling. The connection is very simple if you have a BT jack socket and even simpler (ie. dispensing with a team of union engineers) if you haven't since it involves connecting two wires.

FACING-UP TO THE WORLD

Interface 1 is a module which connects the Spectrum to the outside world. There are two 'portals' (disregarding the Microdrive which it also controls). One is a local area network interface, the other is an RS232 interface.

With Interface 1, using the leads supplied you can connect to up to 64 Spectrums. You can share programs, data and devices so that one person could have a posh printer, one a set of Microdrives and so on. Messages can be sent from any one station to any other, or they can be broadcast. The printer server program allows one Spectrum on the net to control an RS232 printer. This printer can then be used by all the

other computers on the net (for a group which has one higher quality printer to share).

All simple symbols (letters, digits, etc) and compound tokens (keywords, function names, etc) can be sent and received by the RS232 interface to and from any compatible serial device (eg. printers, modems, or other RS232 interfaces connected to other kinds of computers). The Spectrum RS232 uses two different channels — the T (or text) channel for sending listings, and the B (or binary) channel for sending the full 8-bit codes used by the the Spectrum, so you can send control codes for printers and so on.

The bit (or baud) rate can be set to any speed from 50 to 19200 bits per second (although 19.2K bit modems are slightly thin on the ground). For more detailed information about this, see 'Broadening your communications Spectrum' at the end of this article.

OTHER ACTION

Richard (Micronet) Hease has been doing his bit to try and rescue Prestel. He's offering a specially adapted V23 modem and software to connect to Micronet. Micronet is Prestel for micro users. The most ambitious project is the downloading of software. This *sounds* great *but* . . . if you go 'on-line' you will catch occasional glitches — character errors. If you know of any randomly fault tolerent software, please let me know. There are special error catching schemes, but then, there's also this ship called the Titanic . . .

The rest of Micronet seems fine but you need to check the *real* costs of on-line browsing.

Micro-Myte is something you myte come across, and 'myte' is the operative word. It mite be useful and it myte work. However, calling it a modem myte even nibble at trades description. Mico-Myte is totally non-standard (and possibly non-approvable), uses the tape recorder outputs on your machine, uses the most precarious acoustic coupler I've ever seen, and inspires great confidence by saying that it operates in simplex mode (actually it's half duplex). One other minor point — you'll only be able to ring up someone else who's bought another Micro-Myte, so no global connections for you.

The great thing about modems in general is to learn before you buy. Failing that, check if your intended purchase is compatible with the system you want to call up. Make sure it can operate in call (originate) and answer modes (some cheapos only do one — which is OK so long as you know the limitations). Check the speed and frequencies because you can't just stick go-faster stripes on.

Lastly, it's worth mentioning that the RS232 is actually the EIA RS232C and is an American interface standard. It's near as dammit international equivalent is the CCITT V24/28. There are 25 pins on the usual interface but not all of them are used. The interface is supposed to be standard but most manufacturers have their own ideosyncrasies.

If you ask me nicely I'll send you a list of the standard connections with a diagram, and further McNulty info from the Datacomms mini-Bible will explain the CCITT 'V' series and all the modem modulation schemes. SAEs all round, please.

Contact John McNully via Interchange Ltd, PO Box 240, Watford 2EH.

BROADENING YOUR COMMUNICATIONS SPECTRUM

(An adventurer's guide to the Spectrum Interface 1)

The network allows for the linking of 2-64 Spectrum computers. The linkage between computers is a two wire system — signal wire and ground wire. Each Spectrum constitutes a station and by using the FORMAT 'n'; x command it is possible to assign the required station number (x) to a given computer. The range of station numbers is 1-64.

Data is transmitted and received on the network in packets. The transmit process is as follows:

1. Wait for the network to be free for between 2-3mS.
2. Try to claim the network by sending a 'scout' signal. Check that there is no contention. Repeat from (1) if there is a collision.
3. Send out a 'header' comprising eight bytes of data (a copy of bytes 11-18 in the network channel area).
4. Wait for an acknowledgement. Repeat from (1) if nothing found with 1mS.
5. Send out the data block comprising 1-255 bytes of data (a copy of the data buffer).
6. Wait for an acknowledgement. Repeat from (1) if nothing is found within 1mS.

The receive process is as follows:

1. Wait for the network to be free for at least 2mS.
2. Wait for the network to become active ('scout').
3. Collect the 'header' block, compute the checksum and acknowledge if it is correct. Repeat from (1) if not. It is correct if it has the correct source and destination station numbers and has the correct sequence number.
4. Collect the data block, compute the checksum and acknowledge if correct. Repeat from (1) if not.

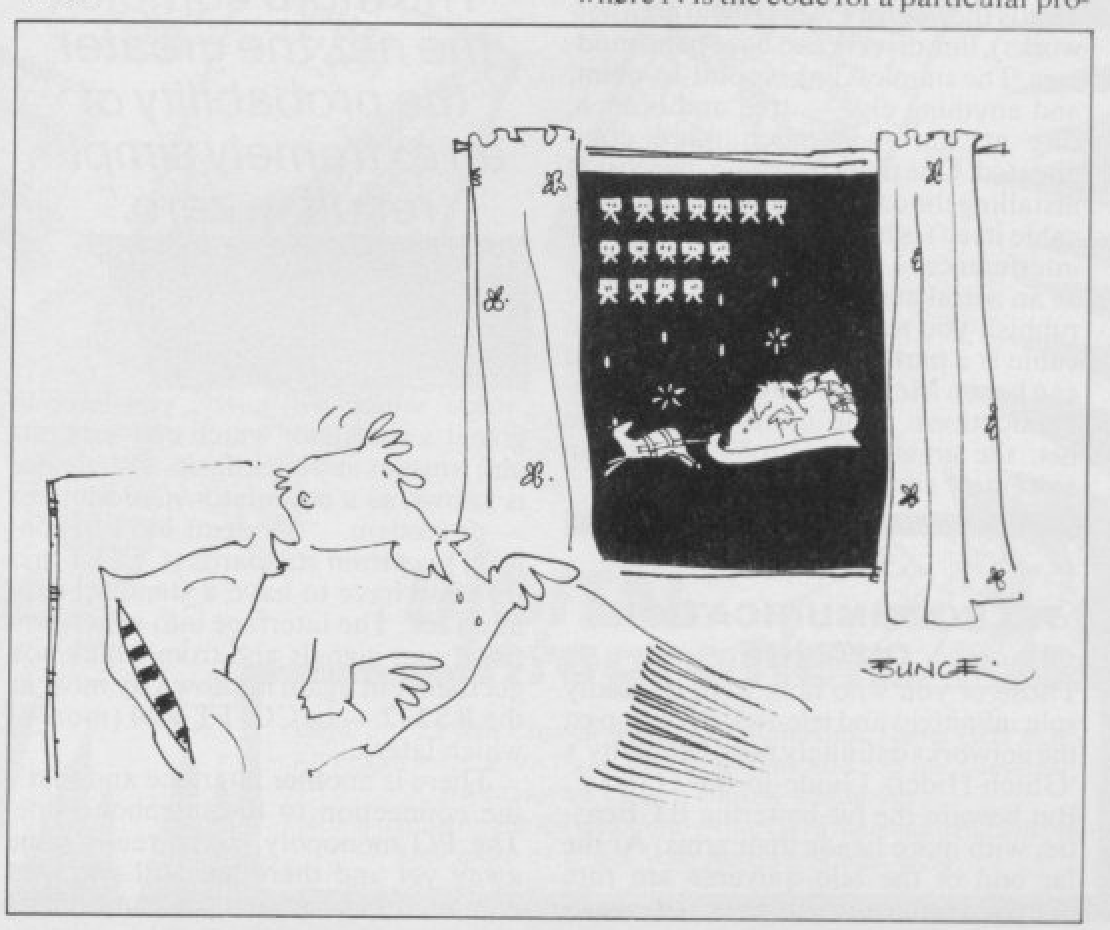
Messages may be *broadcast* to more than one station. The protocol is as above, but no acknowledgments are required. The receiver must be expecting a broadcast. A 'scout' and 'header' pair take about 1.6mS and are repeated about once every 8mS if not acknowledged. A 'scout', 'header' and data block containing 255 bytes takes about 37mS. Stations wait a random interval after the network has become free before transmitting packets. This scheme avoides time consuming collisions.

PROCEDURES

To make the job of writing application software easier, procedures in the new ROM have been made available. These are called with the following two byte call:

```
RST   8
DEFB  N
```

where N is the code for a particular pro-



cedure. The procedures, their codes and parameters are described below. All registers are corrupted. If the procedure cannot complete the request or if it is interrupted (if the BREAK key is pressed) it makes an error return. This means that it loads SP from ERR_SP and returns. This allows the caller to handle errors. The reader should note that the new system variables should be created before they can be set up prior to calling any procedure. This is achieved by calling procedure code 49 first. Register IY should point into the system variables at 5C3Ah when any of the procedures are called.

Console input (code 27): This procedure waits for a character to be typed in on the Spectrum keyboard and returns it to the A register. Nothing is printed on the screen.
Console output (code 28): This procedure prints the character in the A register in the upper part of the screen.
RS232 input (code 29): This procedure waits for a character received on the RS232 serial interface. The baud rate is specified by BAUD in the system variables. The format is eight data bits, one stop bit. No framing error is generated if the stop bit is missing. The byte is returned in register A.
RS232 output (code 30): This procedure outputs the byte in A on to the RS232 serial interface. The baud rate is specified by BAUD in the system variables. The transmission format is eight data bits, two stop bits, no parity.
ZX printer output (code 31): This procedure outputs the byte in the A register to the ZX printer.
Keyboard test (code 32): This procedure tests to see if a key has been pressed. The carry flag is set if a character is available.
Open network channel (code 45): This procedure opens a network channel to the station whose number is stored in D_STR1. Our current station number should be stored in NTSTAT. A network area is created in CHANS; everything else in memory up to STKEND is pushed up. The address of the channel is returned to IX.
Close network channel (code 46): This procedure closes the network channel specified by IX. If the buffer contains data yet to be seen (NCOBL>0) then this is sent in a final packet before the channel is deleted.
Get packet (code 47): This procedure gets the next packet for the network channel identified by IX. NCNUMB identifies the required block number. (Both this block and the previous one will be acknowledged in case our acknowledgement to the last block was lost.) The procedure returns within 12mS if there is no packet available. If an appropriate packet arrives the procedure may take a further 37mS. If the procedure is waiting for a broadcast (NCIRIS = 0) then it does not return until a packet is received. The carry flag is set if no packet is available or if the received packet was erronious in some way. The packet 'header' and data block can be found in the channel starting at NCIRIS and NCB respectively. NCNUMB is incremented.
Send packet (code 48): This procedure sends a packet from the network channel identified by IX. The number of bytes in the data buffer is specified by NCOBL (must be>0). The byte in A is stored in NCTYPE. NCNUMB is incremented. The procedure does not return until the packet has been sent and an acknowledgement received (no acknowledgement is necessary in the case of a broadcast, ie. NTDEST=0).
Create system variables (code 49): This procedure creates a space for and initialises the new system variables described above. This should be called before attempting to set up any of these variables prior to calling any of the above procedures.

THE NETWORK CHANNEL

When a stream is opened to the network a channel is created in the area designated CHANS in the Basic reference manual. This area is usually addressed by the IX register in the software. The channel has a length of 276 bytes. The contents of the channel are described as follow:

0		*Address 8*
2		*Address 9*
4		*'N'*
5		*Address of output subroutine in ROM*
7		*Address of input subroutine in ROM*
9		*Address 276*
11	NCIRIS	*The destination station number*
12	NCSELF	*This is the Spectrum's station number*
13	NCNUMB	*The block number*
15	NCTYPE	*The packet type code. . .0 data, 1 EDF*
16	NCOBL	*The number of bytes in the data block*
17	NCDCS	*The data checksum*
18	NCHCS	*The header checksum*
19	NCBL	*The position of the last character taken from the buffer*
20	NCB	*The number of bytes in the input buffer*
21		*A 255 byte data buffer*

Temporary network channels are created and deleted afterwards during SAVE, LOAD, VERIFY and MERGE commands. They may also be created from machine code.

SYSTEM VARIABLES

The Microdrive, LAN and RS232 software uses more system variables; these are described as follows:

23734	FLAGS3	*Flags*
23735	VECTOR	*Address used to extend the Basic interpreter*
23737	SBRT	*ROM paging subroutine*
23747	BAUD	*Two byte number determining the baud rate, calculated as follows: BAUD=(3500000/(26 x baud rate))–2*
23749	NTSTAT	*Own network station number 1-64*
23750	IOBORD	*Border colour used during I/0*
23751	SER_FL	*Two byte workspace used by RS232*
23753	SECTOR	*Two byte workspace used by Microdrive*
23755	CHADD_	*Temporary store for CH_ADD*
23757	NTRESP	*Store for network response code*
23758	NTDEST	*Beginning of network buffer, contains destination station number 0-64*
23759	NTSRCE	*Source station number 1-64*
23760	NTNUMB	*Network block number 0-65535*
23762	NTTYPE	*Header type code*
23763	NTLEN	*Data block length 0-255*
23764	NTDCS	*Data block checksum*
23765	NTHCS	*Header block checksum*
23766	D_STR1	*Start of eight byte file specifier, two byte drive number 1-8*
23768	S_STR1	*Stream number 1-15*
23769	L_STR1	*Device type. . .'M', 'N','T' or 'B'*
23770	N_STR1	*Length of filename*
23772		*Start of filename*
23774	D_STR2	*Second eight byte file specifier used by MOVE and LOAD commands*
23782	HD_00	*Start of workspace for SAVE, LOAD, VERIFY and MERGE. Data type code*
23783	HD_0B	*Length of data 0-65535*
23785	HD_0D	*Start of data 0-65535*
23787	HD_0F	*Program length 0-65535*
23789	HD_11	*Line number*
23791	COPIES	*Number of copies made by next SAVE command*
23792		*Start of Microdrive MAPs or CHANS*

It's easy to feel that the glut of computing books forgo the rudiments of the craft and settle for lots of games for the frogger freak. But, asks Alan Jowett, could it be that the authors of these texts ignore a rather vital question. What is a book?

PAPERDATA

Anthony Burgess, the *Clockwork Orange* man, described books in a recent colour supp ad as "boxes of organised knowledge". But too many of the micro volumes sitting in the racks round at the dealers are really collections of old magazine programs, writ large and often writ fast. No worse for being collected, but no better either.

"The first rush of books on the Sinclair machines has been, to put it kindly, disappointing. Certainly none can be considered a serious text on Sinclair Basic. We felt that a book was needed which gave the first time user a worthwhile home tutor on computing," so say the authors of Century's new *Computer Programming Course.* Perhaps they're right.

Have you or your kids been up at night furrowing over fuzzy repros from a defunct ZX printer. . . are you wasting your time on books that aren't worth the paper they are printed on? And it's sobering to consider just how many Sinclairs are listed in the 'Swaps and For Sale Cheap' columns because the owners have got fed up with the turgid prose of their books. The majority of the tightly crammed pages are in their way as unreadable as the 60's underground magazines that used to print green ink on purple pages. Indeed, one unmentionable guide went for four pages before introducing a new paragraph! The impression is that many are written by scientists or science teachers 'on the make'.

True fans of everything that Clive Sinclair originally begat will want to invest the full £9.95 on the aforementioned *Century Programming Course,* a massive 525 pager that takes you right through every nook and cranny of the ZX81 and Spectrum. If you believe that your interest in Sinclair Basic is going to persist for the next few months, let alone years, then probably this is the one. It might have been more logical, however, to have brought in the Spectrum system and keyboard at an earlier stage than page 439 in section W, as if assuming that everybody is progressing from a ZX81 first.

A BETTER MANUAL

There's far less about programming in Ian Sinclair's *The ZX Spectrum and how to get the most from it* (Granada, £5.95). It's probably the best of the general guides and it seems to aim towards being more readable than the manual that accompanies the machine itself. This Sinclair must have made a mint from those who assume that he has kinship with our great Mensa sage, but I wouldn't begrudge a penny of it. Sinclair Minor actually tries to make a few jokes — nothing actually very funny, but enough to make things more readable and any attempts at whimsy are worthwhile.

Sinclair doesn't make the pedagogic mistake of thinking that lack of knowledge equals lack of intelligence. But he does provide welcome diagrams for newcomers to the art, and a breakdown checklist. Advanced readers of this column may quietly sigh, but they were once beginners, and not that long ago either. The computer clubs are full of people wondering why their Spectrums won't work, and most of the answers will be found here.

Actually, for those truly at the starting gate, for my money the best book to buy is *First Steps with your Spectrum* — my fave rave for any Sinclair computing course. Authoress Carolyn Hughes ran computer courses at her sons' school. She has provided a manual that sensible dealers could pop in with the Spectrum as a goodwill gesture (it only costs £1.25 from Armada) and one that should have any reader from eight



SPIKE DAVIES

to eighty programming in half an hour. Tim Hartnell, who has not been slow off the mark in dashing off a few million words of his own, adds in a foreword "There are lots of books written about the Spectrum. They were not written with *you* in mind."

The point is, were they written with anyone in mind? Apart from the bank manager that is.

Is it beyond the wit of publishers to attract a real writer to investigate the world of programming — and compose a book that is enjoyable to read, to handle and to program from? If you think that Fleet Street journalists spend all their time making up stories and muckraking, cast an eye at *The Sunday Times book on Skiing,* mostly written by Harold Evans. Technical material is superbly illustrated and magnificently described and it has the reader almost leaping on the next plane in a mad urge to be out there on the slopes. Hands up all those who've ever had a thrill like that from reading a programming book.

GOON-CRACK IT!

Watching the hordes in W H Smith clutching at books geared to their own machines leaves you wondering how wide their view of the world is. Because buying a Spectrum doesn't mean you've started using your brains yet — the box can't actually do anything on its own. Few programming books tell you that one of the most important skills is patience; knowing how to de-bug is all about mind over matter most of the time. Walking the dog, reading poetry, listening to Brahms might help, but the books don't contradict the idea that the micro is what's all important. It's easy enough to pick up a smattering of Basic and learn how to doodle a bunch of pixellated munchkins all over the screen, but the books don't encourage you to ask any of the global questions.

The best programming book I've seen over the past two years had not a single program in it and was nothing to do with the Spectrum or any other machine. But *Design and Memory* (McGraw Hill — John Wiley, £8.50) is the one I'd take to that desert island.

Full of wisecracks aimed at programmers in big corporations it's still highly relevant to Spectrum users — after all, a lot of us have 48K at our fingertips and that was more than mainframe power only a few years ago. Peter Huyck and Nellie Kremenak urge programmers to get themselves to think of people as being useful, and to discover how the machine can help in their own lives. Too many Spectrum owners get their value out of the machine as a quick thinking toy, never seeing it as a way of helping to develop themselves.

OK, so you don't want to learn archaic algebraic formulae. But, as the book points out, a good programmer is much like a jackleg carpenter — and they don't read philosophy either. And snippets of Reader's Digest aphorisms filtered through MAD magazine keep cropping up, telling you to summarise the condition of humankind in 25 words or less, or to cycle down to Kitty Hawk and feel the breeze coming from the South. Find one aspect of programming that inhibits innovation, they urge. Their approach is that there are only four billion of us at the moment and you can't assume that somebody else is asking those vital questions.

We're all getting the benefit of immensely clever chaps like Sir Clive and his Mensa friends. But let's not pretend there aren't holes in our ways of looking at the world.

Logic is flexible but too many programmers are too rigid and impatient to try trial and error methods. Librarians are just the same. Huyck tells the parable of how titles of books in Oriental languages are transliterated into the Roman alphabet and filed by the ordering rules for English titles. The rules are devised by Westerners but most people looking for books in Oriental languages are Orientals, so no one can find anything in the Oriental collection.

Logic, philosophy and programming are all useful to each other. Bits of informed approaches will rub off on micro programmers over the years, but not if we just stay put in front of the same half dozen reliable guides. Don't just look under the safe old Dewey code of 001.642 in the library stack — let your fingers walk a few inches on both sides. After all, life is a bit of an adventure.

HEARING IS BELIEVING

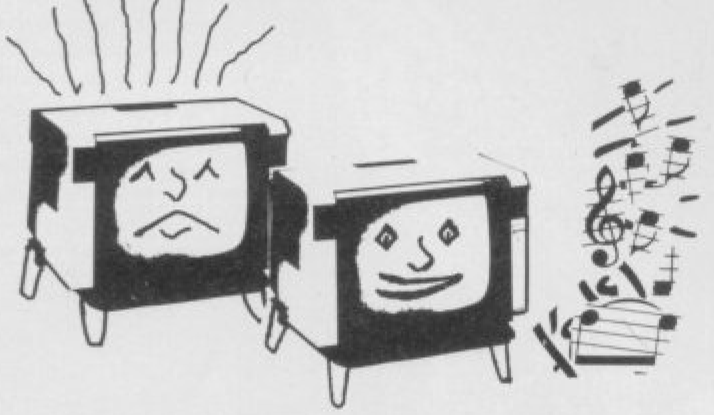
Tele Sound

SPECTRUM BEEP BOOSTER

TELESOUND is ready built and tested so that you can get the full sound of your Spectrum through any unmodified television set, black and white or colour. The unit is easy to fit in minutes without any previous experience as full fitting instructions are provided.

TELESOUND has been designed using the very latest ultra miniature components so it's size is an **incredible 2 x 1.3 x 1mm. and fits neatly inside** the Spectrum. Three easy push-on connections are made to the Spectrum. The connections are clearly shown in a diagram that comes with full fitting instructions.

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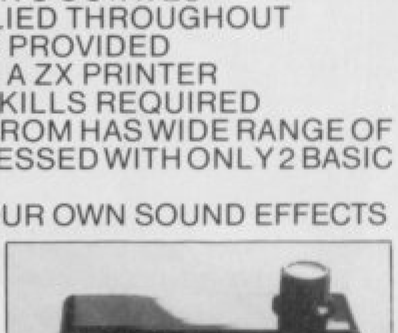
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SIR CLIVE

Welcome to the first selection of programs, hot off the keyboard and trembling with anticipation at being tapped into the nation's Spectrums. Over the coming issues, we'll be aiming to provide a wide range of software that will include games, domestic and utility programs. But (and don't look too hard at some of this month's offerings!) our one priority will be to bring you structured listings from which you can learn how to program efficiently.

Obviously, as this is the first issue of *Your Spectrum*, you haven't heard of us any more than we've heard of you . . . yet. However, if you fancy carving your niche in the *YS* software hall of fame, then send in anything you think is good — and maybe we'll publish it. (We pay better than most — but they've got to be good!)

But enough of the solicitations . . . why not type in our first listing — you'll soon get the message.



A screen from the Sir Clive listing. Note the extremely high-resolution graphics possible using the Spectrum's PLOT and DRAW commands.

```
   1 REM "clive48"
  10 DIM b$(704): BORDER 6: PAPE
R 6: INK 0: CLS
```

Lines 1-10 Set up the screen attributes.

```
 999 RESTORE 2000
1000 READ y,x,z: IF x=-1 THEN GO
 TO 5000
1010 PLOT y,x: DRAW 0,z
1020 GO TO 1000
1999 REM Line data
2000 DATA 5,76,3,5,28,5,6,25,3,6
,32,13,6,76,4,7,24,3,7,37,13,7,7
5,4
2010 DATA 8,22,3,8,45,16,8,74,5,
9,10,4,9,21,3,9,49,16,9,73,5,10,
6,4,10,20,3,10,58,12,10,72,8,11,
2,4,11,19,3,11,64,13,12,17,3,12,
70,5,13,15,5,13,85,2,14,16,2,14,
85,2,15,84,3
```

```
2020 DATA 16,85,2,17,85,2,18,85,
2,19,65,4,19,71,3,20,53,2,20,64,
7,21,49,3,21,62,16,22,47,32,23,4
4,35
2030 DATA 24,41,41,25,39,43,26,3
7,46,27,37,47,28,36,51,29,30,58,
29,118,8,30,28,61,30,116,2,30,12
6,2,31,26,64,31,114,2,31,127,7
2040 DATA 32,26,66,32,129,7,33,2
0,2,33,23,71,33,99,4,33,120,6,33
,131,6,34,22,76,34,100,2,34,120,
6,34,131,6,35,20,78,35,100,2,35,
116,10,35,130,6,36,19,84,36,110,
4,36,116,10,36,128,6,37,2,4,37,1
3,6,37,22,86,37,110,24,38,23,86,
38,116,17,39,23,87,39,116,18
2050 DATA 40,19,2,40,24,90,40,11
8,16,41,19,2,41,24,88,41,115,24,
42,17,69,42,92,23,42,121,20,43,1
7,70,43,94,22,43,121,22,44,16,71
,44,89,2,44,98,20,44,119,25,45,1
4,74,45,100,9,45,112,34,46,13,68
,46,83,8,46,94,3,46,104,2,46,116
,31,47,2,84,47,87,3,47,91,5,47,1
16,34
2060 DATA 48,11,69,48,81,3,48,87

,5,48,96,2,48,118,3,48,125,29,49
,20,48,49,95,5,49,121,33,50,18,5
2,50,92,3,50,116,2,50,121,36,51,
18,52,51,92,3,51,114,2,51,126,31
,52,17,53,52,112,2,52,128,2,52,1
31,14,52,146,12,53,2,4,53,14,56,
53,91,3,53,108,4,53,129,5,53,135
,10,53,147,13,54,0,74,54,106,2,5
4,144,3,54,149,11,55,0,75,55,98,
4,55,146,2,55,150,10
2070 DATA 56,0,68,56,69,7,56,90,
3,56,102,3,56,147,2,56,151,11,57
,0,64,57,70,7,57,89,3,57,148,3,5
7,152,12,58,0,60,58,71,5,58,90,3
,58,106,2,58,156,2,58,160,2,59,0
,61,59,71,5,59,90,3,59,106,2,59,
156,7,60,0,55,60,71,5,60,90,2,61
,0,55,61,56,4,61,70,6,61,90,2,62
,0,19,62,20,31,62,66,9,62,89,2,6
3,0,5,63,7,42,63,64,12,63,89,2,6
3,159,2
2080 DATA 64,0,47,64,54,2,64,62,
4,64,67,7,64,108,2,65,0,46,65,49
,3,65,61,4,65,66,8,65,108,2,66,0
,16,66,17,32,66,61,3,66,66,6,67,
0,46,67,60,3,67,66,7,67,105,3,68
,0,6,68,17,29,68,53,2,68,60,2,68
,65,8,68,105,4,69,23,24,69,52,3,
69,59,3,69,64,11,69,104,5,70,21,
24,70,52,4,70,58,4,70,63,15,70,1
05,4,71,19,26,71,52,2,71,57,4,71
,63,19
2090 DATA 72,16,4,72,26,5,72,35,
10,72,46,2,72,56,4,72,62,15,72,8
1,4,72,105,3,72,110,3,73,35,11,7
3,56,3,73,62,15,74,35,10,74,51,2
,74,56,3,74,62,15,75,16,28,75,56
,3,75,62,15,76,2,36,76,39,9,76,5
6,3,76,61,2,76,64,12,76,104,2,77
,2,48,77,56,3,77,61,2,77,64,11,7
7,102,2,77,105,2,77,112,2,78,34,
6,78,44,4,78,63,11,78,80,3,78,10
4,2,78,111,4,79,37,13,79,63,8,79

,92,2,79,103,2,79,110,5

3000 DATA 80,38,12,80,60,2,80,64
,6,80,93,5,80,102,3,80,109,5,81,
38,8,81,47,4,81,60,2,81,63,7,81,
101,3,81,107,7,82,39,12,82,61,10
,82,94,2,82,98,6,82,107,7,83,39,
13,83,61,10,83,107,5,84,40,4,84,
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45,8,84,63,8,84,106,2,85,41,11,8
5,63,3,86,42,11,86,61,10,87,42,1
1,87,63,2,87,66,2,87,70,2
3010 DATA 88,43,12,88,61,2,88,64
,2,89,44,12,89,60,6,90,45,12,90,
60,6,91,45,18,92,45,8,92,57,7,92
,86,9,93,47,6,93,59,2,93,83,3,94
,47,8,94,98,2,95,48,6
3020 DATA 96,49,6,97,50,5,98,54,
3,99,54,4,99,96,3,99,102,2,100,5
5,4,100,97,2,100,102,2,101,56,3,
101,95,4,101,101,3,102,58,3,102,
93,2,102,96,2,102,101,3,103,60,2
,103,94,5,103,101,3
3030 DATA 104,62,2,104,96,3,104,
101,3,105,63,3,105,94,4,105,101,

2,106,66,3,106,96,2,106,100,2,10
7,69,2,107,96,2,108,94,4,109,93,
4,110,94,2,111,93,2,111,163,3
3040 DATA 112,78,2,112,163,2,113
,0,2,113,162,2,114,87,2,115,0,4,
115,88,4,115,160,2,116,0,6,116,6
0,2,116,159,2,117,0,9,117,58,2,1
17,86,2,117,92,2,118,0,6,118,7,2
,118,56,2,118,157,3,119,0,6,119,
9,4,119,52,4,119,88,2,119,93,3,1
19,156,3
3050 DATA 120,0,5,120,18,2,120,4
8,4,120,94,6,120,155,3,121,3,3,1
21,11,3,121,20,10,121,42,6,121,9
2,2,121,96,6,122,4,3,122,13,2,12
2,30,12,122,94,9,122,149,2,122,1
53,3,123,0,2,123,4,4,123,100,5,1
23,147,3,123,151,4,124,0,2,124,5
,4,124,16,2,124,100,7,124,144,4,
124,149,5,125,0,4,125,7,4,125,18
,3,125,101,8,125,142,5,125,150,2
,126,9,2,126,22,2,126,101,13,126
,138,8,126,147,4,127,2,4,127,10,
4,127,102,13,127,135,12,127,148,
2
3060 DATA 128,3,3,128,104,14,128
,119,2,128,123,25,129,0,2,129,10
8,11,129,125,21,130,110,13,130,1
26,18,131,25,2,131,111,13,131,12
7,17,132,2,2,132,16,2,132,25,4,1
32,116,2,132,127,16,133,4,4,133,
10,3,133,17,9,133,128,15,134,6,3
,134,12,10,134,130,10,135,7,4,13
5,131,8
3070 DATA 136,0,3,136,10,3,136,1
34,2,137,2,4,137,11,4,138,14,4,1
39,18,2,142,4,4,142,14,2,143,8,7
4999 DATA -1,-1,-1
```

Lines 999-4999 This section of the program draws the vertical lines, starting from the left-hand side of the screen. The data contains details for all the straight lines which make up the drawing of Sir Clive Sinclair.

```
5000 RESTORE 5030
5010 READ x,y: IF x=-1 THEN GO T
O 6000
5015 PLOT x,y
5020 GO TO 5010
5029 REM Point data
5030 DATA 10,14,11,15,12,15,12,8
5,16,18,17,19,17,66,17,68,18,20,
18,62,18,70,19,21,19,51,19,60,19
,86,20,22,20,58,20,60,20,72,20,8
6,21,23,21,44,21,47,21,53,22,24,
22,42,23,25,24,26,24,38,25,27,25
,36,26,28,26,34,27,29,27,34,28,3
0,28,32,29,28,30,104,31,103
5040 DATA 32,24,32,102,33,118,34
,20,37,10,39,19,39,21,40,21,41,2
2,44,92,45,91,45,94,46,98,47,99,
48,92,49,78,49,81,49,84,49,86,49
,90,49,92,50,97,50,100,51,100,52
,91,52,95,52,98,53,99,53,101,54,
91,54,96,54,134,55,91,55,95,55,1
05,55,137
5050 DATA 56,94,57,93,57,145,58,
61,58,163,60,101,60,109,60,157,6
0,162,61,109,61,114,61,162,62,53

,62,55,62,100,62,108,62,160,63,5
0,63,53,63,100,63,103,63,108,63,
111,64,50,64,89,64,111,64,113,64
,165,65,47,65,89,65,111,65,163,6
6,50,66,54,66,89,66,108,66,110,6
6,166,67,47,67,54,67,89,67,110,6
8,89,68,110,68,112,69,76,69,89,6
9,110,69,112,70,47,70,89,70,112,
71,83,71,89,71,105,71,108,71,110
,71,112
5060 DATA 72,52,72,89,73,52,73,8
4,73,89,73,111,74,46,74,48,74,90
,74,106,74,110,74,113,75,48,75,8
4,75,90,75,92,75,106,75,110,75,1
13,76,50,76,91,76,93,76,109,76,1
13,77,91,77,93,77,109,78,7,78,48
,78,57,78,61,78,92,78,102,78,108
,79,51,79,57,79,61,79,95
5070 DATA 80,57,81,57,81,94,81,9
7,82,58,83,56,83,96,83,102,84,61
,84,97,84,104,85,61,85,100,85,10
6,87,61,88,71,88,98,91,96,93,57,
93,62,93,95,93,97,94,61,94,82,94
,96,95,81,95,97,95,100
5080 DATA 96,80,96,98,96,100,97,
80,97,96,97,98,97,101,98,79,98,9
6,98,98,98,102,99,79,100,78,100,
94,101,78,101,93,102,78,103,78,1
04,77,104,94,105,77,106,77,107,7
7,107,100,106,167,107,166,108,77
,108,165,109,164,110,75,110,82,1
10,162,110,165,111,83,111,161
5090 DATA 112,84,112,160,113,79,
113,159,114,159,114,161,115,158,
116,157,117,89,117,156,117,159,1
18,155,119,16,120,11,120,22,121,
0,121,151,121,158,122,0,122,23,1
23,15,123,35,126,1,127,116,129,4
,129,123,130,1,130,4,130,10,131,
1,131,5,132,6,135,140,140,20,141
,20
5999 DATA -1,-1,-1
```

Lines 5000-5999 This section of the listing comprises the details of the sketch which are not made up of straight lines.

```
6000 LET A$="SIR CLIVE SINCLAIR"
: LET y=0: LET x=2: GO SUB 8000
6010 LET a$="""OUR HERO""": PAPE
R 2: INK 6: FLASH 1: LET y=13: L
ET x=20: GO SUB 8000
6012 FOR i=1 TO 2: RESTORE 9000:
: FOR j=1 TO 8: READ t,n: BEEP t
,n: NEXT j: NEXT i
6015 PAUSE 1: PAUSE 100
6020 DIM a$(18): PAPER 6: INK 0:
 FLASH 0: LET y=0: LET x=2: GO S
UB 8000
6030 DIM A$(10): LET y=13: LET x
=20: GO SUB 8000
6040 PAUSE 1: PAUSE 50
```

Lines 6000-6040 y and x give the position of the message, a$, to be printed. The messages are printed out tele-type style by the subroutine at line 8000. Line 6012 plays the 'hero' tune from the data in line 9000. Lines 6020-6040 clear the messages once they have been on the screen for the set period.

```
6050 BORDER 5: PAPER 5: PRINT AT
 0,0; OVER 1;b$: INPUT ""
6060 LET A$="I THINK,": LET y=9:
 LET x=20: GO SUB 8000
6070 DIM a$(14): LET A$="THEREFO
RE I AM": LET y=10: LET x=16: GO
 SUB 8000
6080 INK 2: PRINT AT 12,18;
"RICH!";AT 13,18;
"";AT 14,18;
""
6090 INK 0: LET c$="£ £ £ £ £ £

£ £ £ £ £ £ £ £ £ £ "
6100 FOR i=1 TO 20: PRINT AT 0,0
;c$: BEEP .1,5: PRINT AT 0,0;" "
;c$: BEEP .1,0: NEXT i
6110 BEEP 1,20
```

Lines 6050-6110 Change the colour of the screen by printing over b$ so that the sketch of Sir Clive is not lost. Lines 6080 and 6090 print the 'RICH' message and the 'dancing' pound notes.

```
6120 BORDER 1: PAPER 1: INK 7: C
LS
6130 PRINT "This could be your p
rogram. All offerings (on casset
te please)  to:"
6140 PRINT "          Your Spectrum.
                 14, Rathbone P
lace,              London.
                    W1P 1DE.''''
6150 PRINT "We pay lots more...
but it       better be good!"
6160 PAUSE 1: PAUSE 0

7999 STOP
```

Lines 6120-7999 Print the last message, inviting you to send in your software to *Your Spectrum* magazine.

```
8000 FOR i=1 TO LEN A$: PRINT AT
 y,x;a$( TO i); FLASH 1;: BEEP .
1,.1: NEXT i: RETURN
```

Line 8000 Prints a$ at screen co-ordinates y, x in a tele-type style.

```
8999 REM Tune data
9000 DATA .1,11,.1,11,.8,16,.05,
11,.05,16,.05,11,.05,16,1,20
9998 STOP
```

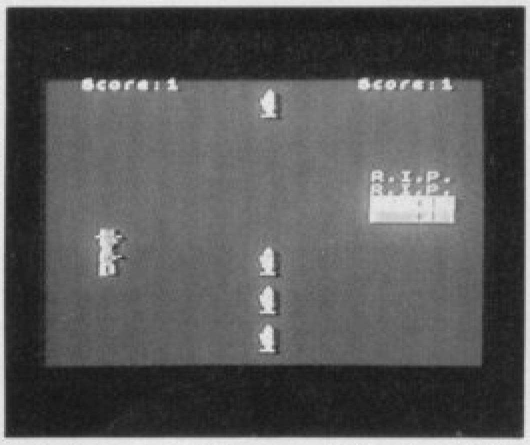
Lines 8999-9998 Contain the data for the 'hero' tune.

SHOWDOWN

Heralded by the strains of the theme tune to *The Good, The Bad And The Ugly*, Showdown (coming to us courtesy of Artic Computing) is an early example of a cowboy gunfight.

To move upwards, use any key from 6 to 0 on the top row and any key from Y to P on the second row will move you down again. The all important fire button can be any key from B to Space on the bottom row. It can be used as a one or a two player game, but be careful if you decide to fight the Spectrum — it proves to be a more than accomplished gunslinger.

With Sheriff Spectrum (on the left of the screen) eager to oust you from town, you'll have to be mighty fast on the draw if you don't want to end up like his last opponent.

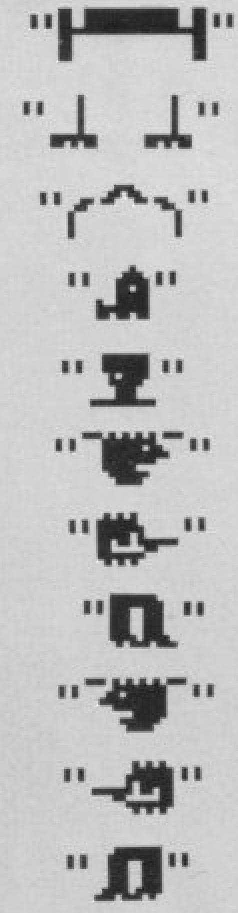


To type in the code needed to generate the user-defined graphics required for Showdown, you should first type in the line of Basic shown below (line 100). When you have done this, RUN the program and type in the graphics code starting with the top line and moving onto the second line and so on; in this case you should type in 0, 0, 1, 6, 12, etc. (where a comma denotes your pressing the ENTER key).

Once you have entered all 168 pieces of code, you should BREAK into the program and type NEW. All the user-defined graphics will then be stored above RAMTOP, and can be typed in in Graphics mode where required in the program.

```
  100 FOR a=0 TO 167: INPUT b: PO
KE USR "a"+a,b: NEXT a
```

0	0	1	6
12	8	8	8
28	54	99	0
0	0	0	0
0	0	96	48
8	8	8	8
207	207	207	255
192	192	192	192
243	243	243	255
3	3	3	3
8	8	8	8
8	8	254	214
126	126	110	62
28	28	28	255
8	28	62	54
62	186	254	214
126	126	110	62
28	28	28	255
160	224	240	240
176	48	240	64
8	3	7	5
253	24	7	5
240	240	112	112
112	112	112	208
7	15	14	14
14	14	14	29
87	240	216	252
240	128	224	192
117	15	15	15
15	15	7	3
87	240	240	240
240	240	224	192
245	15	27	63
15	1	7	3
5	7	15	15
13	12	15	5
64	192	224	160
191	24	224	64
15	15	14	14
14	14	14	11
224	240	112	112
112	112	112	0



Line 150 — is graphic "D E"
is graphic "F F"
is graphic "ABC"
Line 160 — is graphic "H"
is graphic "I"
Line 300 — is graphic "ON"
is graphic "RS"
is graphic "TU"
Line 330 — is graphic "QP"
is graphic "KJ"
is graphic "ML"

```
  3 BORDER 0: PAPER 0: INK 7: C
LS
  4 POKE 23676,127
  5 LET q=0: LET sp=-1
```

Lines 3-5 Set the initial screen colours. The POKE command lowers the user-defined graphics area to that of a 16K Spectrum, as the graphics will be loaded as code.

```
   6 CLS : PRINT TAB 10;"Show-Do
wn";AT 0,10; OVER 1;"________"
  10 LET p=0: PRINT '''" Welcome
 to the Wild West where people l
ive by the ""law of the gun""."
: PRINT AT 21,0;"Do you want ins
tructions?": GO SUB 27: LET a$=p
$: IF a$<>"n" AND a$<>"N" AND a$
<>"y" AND a$<>"Y" THEN PRINT AT
1,0;: GO TO 10
  11 LET p=0: PRINT AT 21,0;"Do
you want the 2 player version":
GO SUB 27: LET k$=p$: IF k$<>"y"
 AND k$<>"Y" AND k$<>"n" AND k$<
>"N" THEN GO TO 11
  12 IF k$="n" OR k$="N" THEN LE
T k$=""
  13 IF a$="n" OR a$="N" THEN GO
 TO 60
  14 PRINT AT 9,0;" On passing t
hrough Creeksville,you have foun
d yourself involvedin a saloon b
rawl over Sweet    Lucy Love (Th
e star of the localSaloon's caba
ret dancers).      You have been
 challenged to a   show down at
sunrise the next   morning."
  15 PRINT AT 21,0;"Press 'ENTER
' when ready.      ": LET p=0:
GO SUB 27
  16 IF k$="y" OR k$="Y" THEN CL
S : PRINT TAB 10;"Show-Down";AT
0,10; OVER 1;"________": PRINT
''"Player One:-": GO TO 36
  17 IF k$="" THEN GO TO 20
  18 GO TO 15
  20 CLS : PRINT TAB 10;"Show-Do
wn";AT 0,10; OVER 1;"________"
  21 PRINT '''" Your opponant is
 the dreaded    SPECTRUM, who is
known to be themeanest, toughest
, fastest        gunshot in the We
st."
  22 PRINT " He is deadly accura
te, never a shot is fired off ta
rget, and hewill hunt you down."
  23 PRINT '"Your only hope is t
o hide behindcacti or the wagons
,and to       strike him suddenly
."
  24 LET p=0: PRINT AT 21,0;"Pre
ss 'ENTER' when ready.": GO SUB
27
  25 CLS : PRINT TAB 10;"Show-Do
wn";AT 0,10; OVER 1;"________"
  26 GO TO 36
  27 LET p$="": LET sp=sp+1: REA
D h,i: IF i=-1.7 THEN GO TO 32
  28 BEEP h,i: LET p=p+1: IF p>3
 THEN LET p$=INKEY$: IF p$<>"" T
```

```
HEN RETURN
  29 DATA .07,15.5,.05,20.6,.05,15.5,.05,20.6,1,15.5,.5,11.5,.5,13.5,1.2,8.5
  30 DATA .07,15.5,.05,20.6,.05,15.5,.05,20.6,1,15.5,.5,11.5,.5,13.5,1.2,18.5
  31 DATA .07,15.5,.05,20.6,.05,15.5,.05,20.6,1,15.5,.5,11.5,.2,10.5,.2,8.5,1.2,6.5,.07,15.5,.05,20.6,.05,15.5,.05,20.6,1,15.5,.5,13.5,1.5,8.5
  32 IF i=-1.7 THEN RESTORE 29: FOR p=1 TO 200: LET p$=INKEY$: IF p$="" THEN NEXT p
  33 IF p$<>"" THEN RETURN
  34 GO TO 27
  36 PRINT '''"Your Cowboy is on the right",''"To move up press any key on the top row from 6 to 0"
  37 PRINT '"To move down press any key on    the second row from Y to P"
  38 PRINT '"To fire press any key on the      bottom row from B to (space)."
  40 LET p=0: PRINT AT 21,0;"Press 'ENTER' when ready.": GO SUB 27
  41 IF k$="" THEN GO TO 60
  42 CLS : PRINT TAB 10;"Show-Down";AT 0,10; OVER 1;"_________"
  43 PRINT ''"Player Two:-"
  44 PRINT '''" Your Cowboy is on the left",''"To move up press any key on the top row from 1 to 5"
  45 PRINT '"To move down press any key on    the second row from Q to T"
  46 PRINT '"To fire press any key on the      bottom row from (caps shift) to V"
  47 LET p=0: PRINT AT 21,0;"Press 'ENTER' when ready.": GO SUB 27
  60 CLS : PRINT TAB 10;"Show-Down";AT 0,10; OVER 1;"_________"
  65 LET p=0: PRINT AT 9,0;"Type 'y' to start"''"Type 'n' to re-read instructions"''"Type 's' to STOP ": GO SUB 27
  66 GO TO (p$="s" OR p$="S")*2+(p$="y" OR p$="Y")*4+(p$="n" OR p$="N")*(-60)+65
  67 STOP
```

Lines 6-67 Print the instructions for the game and play the various tunes while the computer waits for the replies to the questions — such as how many players will be playing, etc. The data for the tune played while the computer waits for an input is stored in lines 29-31.

```
  69 IF k$="" THEN CLS : PRINT TAB 10;"Show-Down";AT 0,10; OVER 1;"_________";AT 9,2;"GOOD LUCK - YOU'LL NEED IT!!": FOR A=1 TO 200: NEXT A
  70 PAPER 1: INK 7: BORDER 0: CLS
  80 LET s1=0: LET s2=s1
  90 FOR q=1 TO 5
 100 LET T=18: LET R=-2: LET G=0
 110 CLS : LET a=INT (RND*6)+2: LET b=4: LET c=INT (RND*6)+10: LET D=27: LET a1=a: LET c1=c
 120 PRINT AT 0,3;"Score:";AT 0,23;"Score:"
```

Lines 69-120 Set up the initial variables for the game.

```
 130 OUT 0,16
 140 GO SUB 300: GO SUB 330
 150 IF Q=2 OR Q=4 THEN PRINT AT 18,15;"▐▀▀▀▌";AT 17,15;"⊥ ⊥";AT 16,15;"╭^╮"
 160 FOR J=1 TO 20 STEP 3: IF Q=2 OR Q=4 THEN PRINT AT 1,16; INK 6;"♣";AT 2,16; INK 6;"♠";AT 19,16; INK 6;"♣";AT 20,16; INK 6;"♠": GO TO 180
 170 IF RND>.4 THEN PRINT AT J,16; INK 6;"♣";AT J+1,16; INK 6;"♠"
 180 NEXT J
```

Lines 130-180 Set up the screen. Line 140 calls the routine to print the cowboy character, and lines 150-170 print the wagon and cactii.

```
 185 REM READ KEYBOARD FOR RESPONSES
 190 PRINT AT 0,9;s1;AT 0,29;s2: LET g=(IN 65278<>255): LET a1=a-(2*(IN 63486<>255))+(2*(IN 64510<>255)): LET C1=C-(2*(IN 61438<>255))+(2*(IN 57342<>255)): LET f=(IN 32766<>255)
```

Lines 185-190 Read the keyboard and check which keys are pressed. (This routine may not work with the new issue 3 Spectrum models.)

```
 200 IF Q=2 OR Q=4 THEN PRINT AT T,15;"     ";AT T-1,15;"     ";AT T-2,15;"     ": LET T=T+R: PRINT AT T,15;"▐▀▀▀▌";AT T-1,15;"⊥ ⊥";AT T-2,15;"╭^╮": LET R=(4*(R+T<6)-2)+(4*(R=2))-(4*(R+T>18)): PAUSE 13
```

Line 200 Prints and moves the wagon.

```
 210 IF c1<19 AND c1>0 AND c1<>c THEN GO SUB 320
 220 LET c1=c
 230 GO TO f*110+240
 240 IF k$="" THEN GO SUB 390
 250 IF a1<19 AND a1>0 AND a1<>a THEN GO SUB 290
 260 LET a1=a
 270 GO TO g*90+280
 280 GO TO 190
 290 GO SUB 300
```

Lines 210-290 Provide the control routine.

```
 300 PRINT OVER 1;AT A,B; INK 5;"▄";AT A+1,B;"☻";AT A+2,B; INK 5;"♞";AT A+3,B; INK 5;"Π"
 310 LET a=a1: RETURN
 320 GO SUB 330
 330 PRINT OVER 1;AT C,D;"▄";AT C+1,D;"☻";AT C+2,D;"♞";AT C+3,D;"Π"
 340 LET c=c1: RETURN
```

Lines 300-340 Contain the routine that prints the cowboy characters.

```
 345 REM FIRE BULLETS
 350 BEEP .0059,25: PLOT 216,155-(c*8): LET e=POINT (133,155-c*8): LET H=POINT (140,155-C*8): DRAW -84,0: DRAW OVER 1; INK 6;83,0: PLOT OVER 1; INK 6;132,155-(c*8): IF e=0 AND H=0 THEN DRAW -95,0: DRAW OVER 1; INK 6;94,0: PLOT OVER 1;37,155-(c*8): LET a$=SCREEN$ (c+2,4): GO TO ((a$<>" ")*180)+240
 360 GO TO 240
 370 BEEP .0059,30: PLOT INK 5;47,155-(a*8): LET e=POINT (131,155-a*8): LET H=POINT (124,155-A*8): DRAW 84,0: DRAW OVER 1; INK 6;-83,0: PLOT OVER 1; INK 6;131,155-(a*8): IF e=0 AND H=0 THEN DRAW 88,0: DRAW OVER 1; INK 6;-87,0: PLOT OVER 1;219,155-(a*8): LET a$=SCREEN$ (a+2,27): GO TO ((a$<>" ")*180)+260
 380 GO TO 280
```

Lines 345-380 The routines controlling the firing of bullets between the two cowboys.

```
 390 IF A>C1+2 OR A<C1 THEN IF RND>.5 THEN LET A1=A-(2*(A>C1+3))+(2*(A<C1))
 400 IF a1+2>=c1 AND a1+2<=c1+3 THEN LET g=1
 410 RETURN
```

Lines 390-410 Contain the routine controlling the movement of the cowboy characters. If you are facing the Spectrum in a shoot-out then you will find that if the two cowboys are not level then the Spectrum's character has a 50 percent chance of moving towards you.

```
 420 RESTORE 550: LET s2=s2+1: PRINT AT a,b;"  ";AT a+2,b;"  ";AT a+1,b-1;"GOT ME";AT a+3,b-1;"█████": FOR W=1 TO 40: NEXT W
 430 IF A<13 THEN PRINT AT a+1,b-1;"      ";AT a+3,b-1;"      ": LET A=13: PRINT AT A,3;"R.I.P.";AT A+2,3;"█████"
 440 FOR Z=A+3 TO A-9 STEP -1: GO SUB 500: PRINT AT Z,3;"      ";AT Z-2,3;"      ";AT Z-3,3;"R.I.P.";AT Z-1,3;"█████": NEXT Z
```



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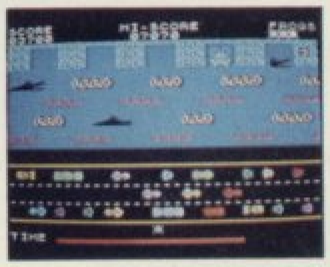
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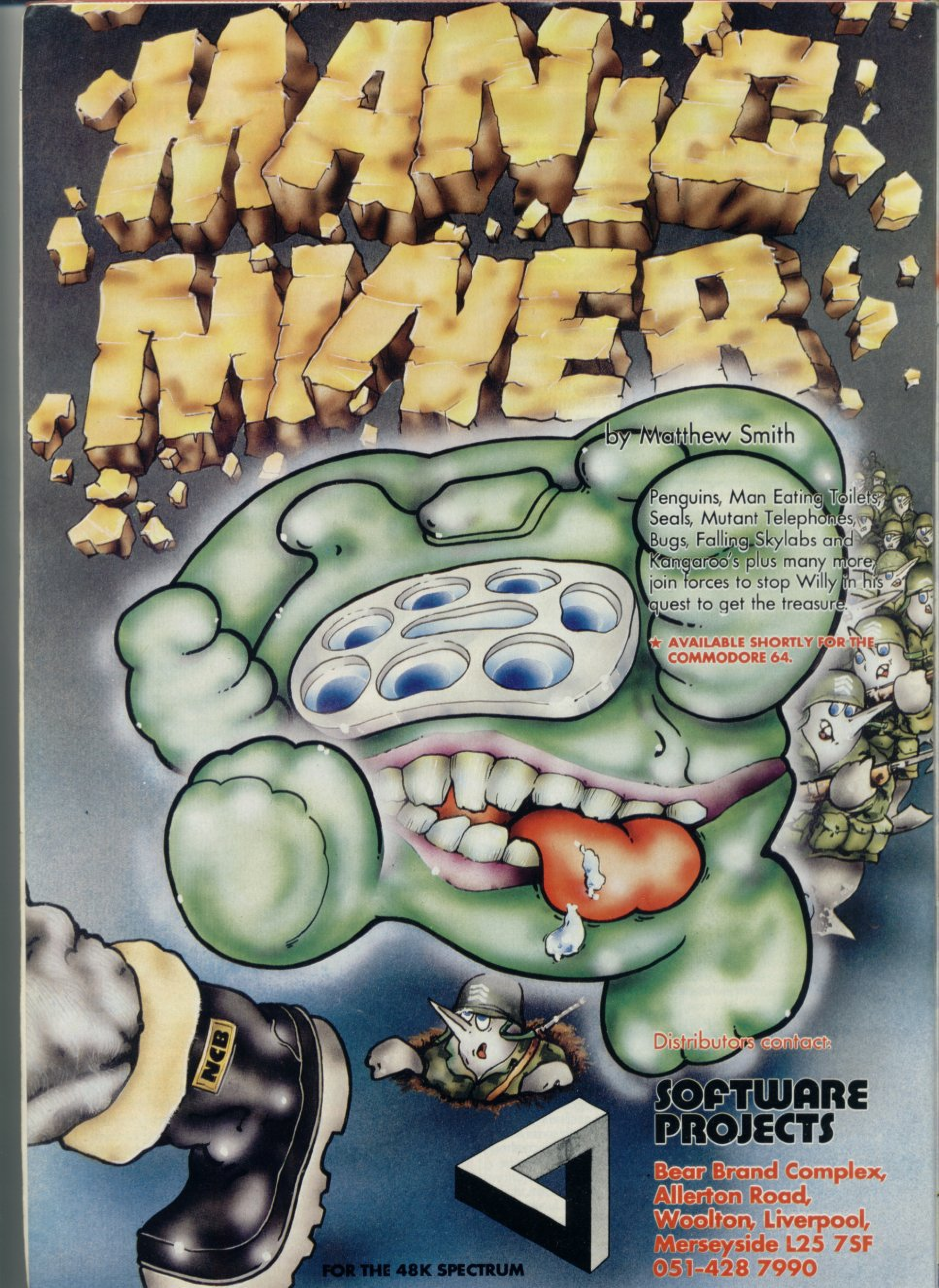
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```
450 GO TO 560
```

Lines 420-450 Should player 1 get shot by his adversery, this routine packs him off in a coffin and mourns his death with a short burst of music.

```
460 RESTORE 520: LET s1=s1+1: PRINT AT C,D;"   ";AT c+1,d;"   ";AT c+3,d;"   ";AT C+2,D;"   ";AT C+1,D-3;"GOT ME";AT C+3,d-3;"███+██": FOR W=1 TO 40: NEXT W
470 IF C<11 THEN PRINT AT C+1,D-3;"        ";AT C+3,D-3;"      ": LET C=11: PRINT AT C,24;"R.I.P.";AT C+2,24;"███+██"
480 FOR Z=C+3 TO C-7 STEP -1: GO SUB 500: PRINT AT Z,24;"      ";AT Z-2,24;"      ";AT Z-3,24;"R.I.P.";AT Z-1,24;"███+██": NEXT Z
490 GO TO 560
```

Lines 460-490 Contain a similar routine to that above, but deal with the eventuality of player 2 biting the dust.

```
495 REM DEATH TUNES PLAYED
500 READ X,Y: BEEP X,Y
510 RETURN
520 DATA 1,-1.7,1,-1.7,.2,-1.7,1,-1.7,.5,1.4,.5,.35,.5,.35,.5,-1.7,1,-1.7,.2,-1.7,1,-1.7
550 DATA .2,-2,.2,1,.5,1,.2,-1,.2,3,.5,3,.2,5,.2,5,.2,3,.2,5,.2,6,.2,8,.6,10
560 NEXT q
565 PRINT AT 0,9;S1;AT 0,29;S2
566 FOR A=1 TO 25: NEXT A: RESTORE 556: FOR A=1 TO 11: READ B,C: BEEP B,C: NEXT A
567 DATA .2,1,.09,-60,.1,-4,.1,-4,.1,-4,.4,-3,.58,-4,.1,-60,.3,0,.09,-60,.2,1
```

Lines 495-567 A collection of data that plays the various tunes that occur once one of the characters is shot. Line 520 plays the tune when player 2 dies, and line 550 does the same for player 1. Lines 565-567 play the tune at the end of the game.

```
570 POKE 23659,1: PRINT AT 22,0; PAPER 0;"Do you want another go? ": POKE 23659,2: LET a$=INKEY$: IF a$="" THEN GO TO 570
580 IF A$="N" OR A$="n" THEN STOP
590 IF a$="y" OR a$="Y" THEN RUN
595 GO TO 570
```

Lines 570-595 Ask the user for another game.

```
600 CLS : PRINT AT 9,1;"PLEASE WAIT WHILE I LOAD THE";AT 11,10;"GRAPHICS": LOAD ""CODE : RUN
```

Line 600 The routine containing the graphics loader.

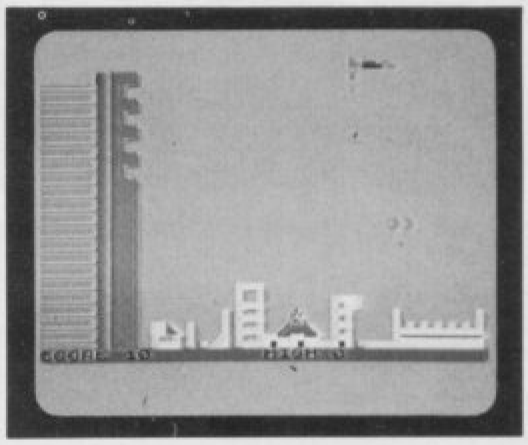
GNASHERS

Gnashers are a rather rare breed of gremlin whose main source of sustenance seems to be the dam which holds back the water from flooding a nearby town. But the local townspeople think nothing of a wave of hungry Gnashers swooping overhead, making their way to the dam to take out another massive bite.

Their confidence comes from the fact that there is a crack squadron of bombers that has so far managed to quell the threat of the Gnashers. That is, until *you* took charge of the planes! You control the plane under automatic pilot by pressing the L key, and to drop a bomb on some unsuspecting Gnasher you simply press the B key. Take care when releasing your deadly missile — the Gnashers fly at much lower levels than your plane's trajectory, so you have to judge very carefully when to drop the bomb so that it collides head-on with the Gnasher.

When you start the game, the task is relatively simple in that the dam comprises three barriers, all of which must be eaten through before the water comes cascading through. However, once you have killed 11 of the Gnashers, the game gets a little more difficult in that the dam now has only two barriers. Again, when you have killed 11 hungry gremlins, you start all over again — this time with the dam made up of only one barrier. Now you've got to keep on your toes because even if you let just one Gnasher through it'll mean that . . . glub, glub, glub . . .

As your bomber squadron flies happily across the top of the screen, have a care for the townsfolk in the streets below – once the Gnashers have eaten their way through the dam, you'll wish you'd packed some water-wings.



```
1 REM "gnashers"
10 LET ts=0
20 GO TO 760: REM instructions+UDG's
30 LET l$="": LET sc=0
45 LET dt=3: CLS : GO TO 70
50 GO TO 40
69 REM draw town & dam
70 FOR i=2 TO 21: PRINT AT i,0; INK 1;"IIII": NEXT i
80 FOR i=1 TO 21: PRINT AT i,4; PAPER 4; INK 0; BRIGHT 1;"A": NEXT i
90 IF dt=1 THEN GO TO 120
100 LET dt=dt-1
110 FOR i=1 TO 21: PRINT AT i,5; INK 4; PAPER 0; BRIGHT 1;"AA"( TO dt): NEXT i
120 INK 7: PRINT AT 17,14;"▛▜"
125 IF dt=1 AND sc>=200 THEN LET dt=10
130 PRINT AT 18,14;"▙▟";AT 18,21;"▛▜ "
140 PRINT AT 19,13;"▌▙▟";AT 19,18; INK 2;"C";AT 19,21; INK 7;"▛▌  ▌     ▌"
150 PRINT AT 20,8; INK 2;"DE"; INK 7;"▌ ▌▙▟ "; INK 2;"DFE"; INK 7;" ▛▜ ▙▙▙▄▄▄▄"
160 PRINT AT 21,8;"▙▟▌▖D▌▙▟"; PAPER 0;"▛"; PAPER 2; INK 7;"F"; PAPER 0;"▛"; PAPER 2; INK 7;"F"; PAPER 5;"▄"; PAPER 0;"▛"; PAPER 5;"▌▄▄▄▌"; PAPER 2;"FFFFFF": INK 0
170 PRINT #1;AT 0,0; INK 4;"████████████████████████████████"
```

Lines 1-170 Draw the town and the dam. The variable, ts (top score), is initially set to zero. l$ is a flag which indicates if the plane is flying. Line 70 draws the water behind the dam, and lines 80-110 draw the dam to the required thickness, denoted by the variable, dt. The last row of the dam is drawn in inverse video so that a flood can be checked for later using the attribute function. Lines 120-170 draw the town and the ground. Finally, line 125 checks to see if you are on the last level of the game and, if so, sets dt equal to ten — to be used as a flag later in the program.

```
180 GO SUB 700
```

Line 180 Prints the score and the current high score.

```
260 REM move gnasher
270 LET qq=1: LET bb=INT (RND*15)+2: LET cc=31
290 LET b1=ATTR (bb,cc)
300 PRINT AT bb,cc; OVER 1; INK 8;"H"
320 PRINT AT bb,cc; OVER 1; INK 8;"H"
340 IF b1>68 THEN PRINT AT bb,cc;" ";AT bb,cc; INK 1;"E": FOR b=22 TO 40 STEP 3: BEEP .001,b: NEXT b: GO TO 540
350 IF b1>64 THEN PRINT AT bb,cc;" ": FOR b=22 TO 40 STEP 3: BEEP .001,b: NEXT b: GO TO 270
360 BEEP .01,40
370 PRINT AT bb,cc; INK 8; OVER 1;"G"
375 IF l$<>"l" AND qq=1 THEN LET z=0: LET l$=INKEY$
380 IF l$="l" THEN GO TO 410+10*(z>=1)
385 PRINT AT bb,cc; OVER 1; INK 8;"G"
390 LET cc=cc-1
400 GO TO 290
```

Lines 269-400 Move the Gnashers. qq is a flag to check that only one bomb is on the screen at any one time. bb is the flag holding the vertical position of a Gnasher, and cc is used to hold the horizontal position, bl is the attribute of the Gnasher's position. Lines 300-320, 370 and 385 print and remove the Gnasher once it has been bombed successfully. Line 340 checks to see if a Gnasher has managed to eat its way through to the last barrier of the dam. Line 350 checks to see if a Gnasher has reached the dam. Line 375 checks to see if the L key has been pressed and, if it has, moves the program to the 'plane' routine.

```
 409 REM move plane
 410 LET pp=1: LET x=0: LET b$="": LET z=1
 420 PRINT AT 0,z-1;" LMN"
 430 BEEP .01,1
 445 IF b$<>"b" AND z>7 THEN LET b$=INKEY$
 450 IF b$="b" THEN LET x=x+1: GO TO 490+5*(pp=0).
 470 IF z<30 THEN LET z=z+1: GO TO 385
 475 PRINT AT 0,z;"    "
 476 LET l$=""
 478 IF b$="b" THEN LET x=x+1: GO TO 495
 480 GO TO 380
```

Lines 409-480 Control the movement of the plane; line 420 is actually the line responsible for the movement of the plane. b$ and pp are two flags which, respectively, check to see if a bomb has been released and whether this is your first call to the bomb routine.

```
 489 REM move bomb
 490 LET pp=0: LET zz=z
 495 PRINT AT x-1+(x=1),zz;" ";AT x,zz;"K": BEEP .01,40-x
 500 IF ABS (zz-cc)<=1 AND ABS (x+1-bb)<=1 THEN PRINT AT x,zz;" ";AT bb,cc; FLASH 1; INK 2; PAPER 6;"J": FOR b=62 TO 24 STEP -6: BEEP .022,b: NEXT b: PRINT AT bb,cc;" ": LET b$="": LET pp=1: LET x=0: GO SUB 680: GO TO 270
 510 IF SCREEN$ (x+1,zz)<>" " THEN PRINT AT x,zz;" ": PRINT AT 0,z;"    ": IF x>15 THEN PRINT FLASH 1; BRIGHT 1; INK 2; PAPER 6;AT x+1,zz;"B";AT x+1,zz;"O" AND RND>.5: LET sc=sc-15: LET b$="": GO SUB 680: GO TO 380
 520 GO TO 470
```

Lines 489-520 This section of the program moves the bomb, where zz is used as the flag holding the horizontal position of the bomb. Line 495 actually prints the bomb. Line 500 checks if the bomb has hit a Gnasher and if so, increments your score, sets the flags and returns. If you should miss the Gnasher and hit the town instead, your score is decremented via line 510, the flags are set and the program returns.

```
 539 REM flood
 540 FOR a=1 TO 3: FOR b=-23.5 TO -22.5: BEEP .045,b: NEXT b: NEXT a: FOR i=bb+1*(bb<>21) TO 21: PRINT AT i,5; OVER 1; INK 1;"I": NEXT i
 550 FOR i=2 TO bb-1: PRINT AT i,0;"      ": NEXT i
 560 FOR i=21 TO bb+1*(bb<>21) STEP -1: PRINT AT i,6; OVER 1; INK 1;"IIIIIIIIIIIIIIIIIIIIIIIIII": NEXT i
```

Lines 539-560 If a Gnasher should eat its way through the dam barrier, this section of code will make the water level behind the dam become lower and draw the water submerging the town.

```
 570 PRINT AT 5,7; INVERSE 1;"THE TOWN IS FLOODED"
 580 PRINT AT 7,7; INVERSE 1;"AND IT'S ALL YOUR FAULT !"
 585 GO SUB 2000
 590 PRINT AT 9,7; INVERSE 1;"YOUR SCORE IS ";sc
 600 IF sc>ts THEN LET ts=sc
 610 PRINT AT 11,7; INVERSE 1;"THE TOP SCORE IS ";ts
 620 PRINT #1;"ANOTHER GAME? (y/n) "
 630 LET a$=INKEY$: IF a$<>"y" AND a$<>"Y" AND a$<>"n" AND a$<>"N" THEN GO TO 630
 640 IF a$="y" OR a$="Y" THEN GO TO 30
```

Lines 570-640 The end of game routine. A tune is played to signify that the game is over and you will be shown your score alongside the current top score.

```
 650 STOP
 680 LET sc=sc+10
 690 FOR b=-16 TO 7.5 STEP 3: BEEP .04,b: NEXT b
 700 PRINT #1;AT 0,0; PAPER 4;"SCORE ";sc;"   ";"HIGH ";ts;"  "
 710 IF sc>=100*1/dt*2 AND dt<>10 THEN PRINT AT 10,10; FLASH 1;"NOW THINGS GET HARDER!": FOR i=1 TO 400: NEXT i: CLS : GO TO 70
 740 RETURN
```

Lines 680-740 This routine increments the score and prints it on the screen if you have managed to get more than 100 points.

```
 760 BORDER 5: PAPER 5: INK 0
 770 CLS
 779 REM instructions
 780 PRINT AT 10,12; FLASH 1;"GNASHERS"
 800 PRINT AT 15,0;"Do you want instructions? (y/n) ": LET a$=INKEY$: IF a$="Y" OR a$="y" THEN GO TO 840
 810 IF a$<>"n" AND a$<>"N" THEN GO TO 800
 830 GO TO 1000
 840 CLS : PRINT "You must defend the dam from the"''
 850 PRINT "marauding "; FLASH 1;"GNASHERS"; FLASH 0;", whose sole"''
 860 PRINT "intent is gnash their way "''"through the dam, thus flooding"''
 880 PRINT "the town. To try to prevent them"''"from doing this, you fly your"''
 890 PRINT "jet plane over the town and drop"''
 900 PRINT "bombs on the Gnashers."''
 910 PRINT AT 21,0;"Press any key to continue": GO SUB 3000
 920 CLS : PRINT "To fly your jet plane on"''
 930 PRINT "automatic pilot press key "; FLASH 1;"L"''
 940 PRINT "To drop a bomb press key "; FLASH 1;"B"''
 960 PRINT '''"GOOD LUCK!"
 970 PRINT AT 21,0;"Any key to start": GO SUB 3000
```

Lines 760-970 This routine checks if the instructions for the game are required by the user. If not, the program moves on the user-defined graphics routine.

```
 999 REM UDG's
1000 PRINT #1;"Please wait": FOR n=0 TO 6 STEP 2: POKE USR "a"+n,85: POKE USR "a"+n+1,170: NEXT n
1010 RESTORE 1500
1020 FOR i=USR "b" TO USR "o"+7: READ n: POKE i,n: NEXT i
1030 GO TO 30
1500 DATA 36,90,165,90,36,24,36,90,56,56,16,214,254,214,16,124,1,3,7,15,31,63,127,255,128,192,224,240,248,252,254,255,0,0,255,255,255,255,255,255
1510 DATA 60,110,255,15,15,255,126,60,60,110,255,127,127,255,126,60
1520 DATA 170,85,0,170,85,0,170,85
1530 DATA 153,90,90,255,255,90,90,153
1540 DATA 0,60,24,60,60,24,0,0
1550 DATA 48,56,60,63,63,63,0,0,0,0,7,255,255,255,127,0,0,0,128,192,248,252,248,0
1560 DATA 74,73,37,18,36,36,102,153
```

Lines 999-1560 This area of the program sets up the user-defined graphics needed in the game.

```
2000 RESTORE 2080
2010 READ a,b
2020 IF a=0 AND b=0 THEN GO TO 2070
2030 IF a=0 THEN GO TO 2060
2040 BEEP b,a
2050 GO TO 2010
2060 PAUSE 1: PAUSE b: GO TO 2010
2070 RETURN
2080 DATA 7,.5,11,.5,14,.5,11,.5,14,.5,16,.5,14,.5,0,25,11,.5,14,.5,16,2,14,.5,0,20,11,.5,14,.5,14,.5,11,.5,12,.5,11,.5,9,.5,0,20,7,.5,9,.5,11,1,9,1,7,.5,0,0
3000 FOR f=1 TO 10 STEP 2: FOR g=1 TO 10 STEP 2: FOR h=1 TO 10 STEP 2: BEEP .1,f+g-h: BEEP .1,g+h-f: BEEP .1,h+f-g: IF INKEY$="" THEN NEXT h: NEXT g: NEXT f: GO TO 3000
3010 RETURN
```

Lines 2000-3010 This routine plays a tune while waiting for the various keys to be pressed at the beginning of the program.

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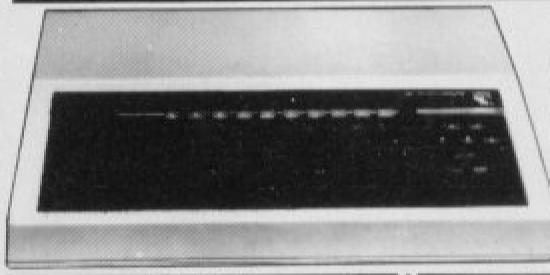
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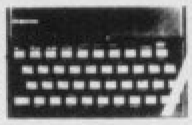
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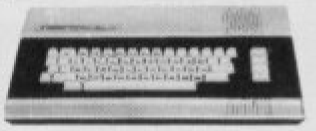
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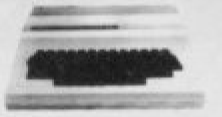
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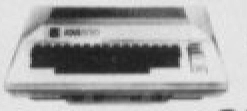


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***Psion is the software firm that put the Horizons tape together for Sinclair Research. And if you ever had any illusions about software companies, forget them — Psion is a highly professional outfit. Tough questions were well parried by Psion's managing director, ex-computer science academic —* David Potter.**

YOUR SPECTRUM: You have a very close relationship with Sinclair Research — do you feel you are bathing in reflected glory at all?
DAVID POTTER: Not at all. We have a good close relationship with Sinclair, that's true. But it has worked to the advantage of both companies. Our software has contributed greatly to the success of Sinclair with both the ZX81 and the Spectrum. We estimate that we have 25 per cent of the Sinclair software market and that's with only a dozen or so titles. But each one of these is a high quality product and most important of all, they are not ephemeral like many of the games for home computers are.

YS: But compared to Sinclair Research you have a very low profile. Is that because you want to keep out of the commercial limelight?
DP: Again it is true we have a lower profile than many of the software suppliers in the micro business. But I would maintain that it is software that sells machines. Sinclair makes sure that we have machines well in advance so that we can get the products to market at the same time as the hardware is ready.

YS: Doesn't that mean that you are relying on Sinclair Research to do a lot of your marketing for you, rather than getting your hands dirty yourselves?
DP: Our first priority is to develop the best software in the world — we should like to become the dominant micro software house in Europe. Yes we could have developed a large distribution arm but we decided not to do that. I think it is a mistake to equate software supplying to pop records or publishing. Movie making is a better comparison. There you have two powers in the market place — the studios that create the product which may cost millions and the distribution chains. We are more like the studio and we leave the marketing to the distributors.

YS: In that case, why don't you have 'stars' in the same way movie studios do? Most of your products are just credited to Psion —no author is mentioned.
DP: I don't think that is the way forward. We are a team of people and I don't think you will find a team that is more dedicated or with a greater sense of commitment and involvement anywhere. The reason for that is that we are the best. We are creating the equivalent of the cars and aeroplanes that were built in the early days of those industries. We are not flashy, we are concerned with craftmanship. That does not mean that our programmers are not looked after. They are very highly paid, as they should be in a prosperous industry. You won't find another company with the capital investment per employee and we have development tools that are second to none —including the larger software houses.

YS: So that means copyright ownership rests with the company — programmers do not get royalites?
DP: Yes. We are concerned with building the reputation of Psion, not individuals. I think it is a mistake to take the attitude of some of the publishers that have moved into software and promote the author. Some of them are finding this out the hard way and starting to take our view and set up professional development teams with high quality tools. It is the only way that you can put our sort of products together. A program like *Flight Simulation* for instance uses lots of very complex mathematics — there are in fact 12 non linear, partial differential equations in that and a lot of sophisticated transformations taking place in real time. You can't get that sort of thing working without a lot of skill and first rate tools. And it works — we've sold something like 250,000 units of *Flight Simulation,* and who knows how many copies there are around.

YS: You acknowledge that your products are copied — is there any way you can protect them?
DP: Sure there is a lot of copying going on and I don't approve of it. We will crush any large scale copying activity but I suppose we must accept the odd person to person situation. The best method is to keep the product cheap in the first place, then people will want to buy the proper product with the documentation that goes with it. We had a lot to do with setting price standards, and software on the Spectrum is cheaper than on any other machine. I think because of that the quality and range of software on the Spectrum is in a league of its own.

I think the worst offenders are teachers who think it is quite moral to buy one copy and spread it around the whole education system. As a result the quality of educational software is awful — no one wants to spend money developing a high quality product that is going to sell only a couple of copies. Teachers don't live in the commercial world and don't see that it has to be worthwhile for a company to get into developing something.

YS: Does that mean that you lose the educational potential of computers — because there is no software?
DP: We are in the early stages of the development of home computers — they are not really functional at this stage. There is no communications available and there is not enough mass storage. But there is tremendous drive for people to learn about computing and that is why Sinclair's cheap computers have been so successful. But we see our products as being educational —take *Scrabble* — that has tremendous educational qualities. Another of our products that has sold very well is *VU-3D* which helps people understand about planes and space.

But the point is that they will not just be fun and not just educational — soon they will become essential parts of our lives. I think a lot of people have bought the Spectrum as a cultural tool — to learn about the computer culture. It's very good for that, despite the criticism it has received, and it's a good deal more powerful than it is given credit for. *Scrabble* uses every byte of a 48K Spectrum and is immensely complex. We were asked to build a Scrabble program for the BBC Micro but I don't think it is possible because the machine can't handle it. There you've only got 32K and lots of that is taken up with the screen processing.

We have purposely tried to bring out software of the highest quality and with Sinclair we have concentrated on sophisticated products that are not necessarily just video games. They are educational in the broadest sense. *Flight Simulation* can teach you a lot about bearings and radials as well as about navigation, for example.

YS: So what is your policy in selecting products?
DP: It's a very competitive market and I think I would stress high quality. We have to follow what the market wants but in some ways we can also lead it — if we do it well. Looking ahead, and without being arrogant about it, we think we can keep it up.

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